F. Natural Environment

1. Topography

a. Existing Conditions

Topography data were obtained through TopoZone.com, which provides interactive maps based upon the United States Geological Survey (USGS) topographic mapping for the country. TopoZone.com provides elevations above mean sea level (MSL) throughout the project area that may be altered by the proposed alternatives.

The project area is located in New Castle County in northern Delaware entirely within the Atlantic Coastal Plain. Topography in the project area ranges from sea level to approximately 80 feet above MSL. The landscape throughout the project area is generally flat, with a few low, wide ridges and narrow, steep-sided stream valleys. A total of five different drainage areas are located within the project area. These watersheds include the C&D Canal East, C&D Canal West, Bohemia Creek Watershed, Sassafras River Watershed, and Appoquinimink River Watershed. Elevations along these low-lying drainages range from sea level to approximately 40 feet above MSL.

The Brown, Purple and Green Alternatives south of the C&D Canal are oriented predominately north-south and are on the drainage divide between the Chesapeake Bay and Delaware Bay drainages. These alternatives follow the same alignment west of existing US 301 along what is commonly referred to as the ridge route. The topography in this area is very flat because it lies at the drainage divide where there is very little erosion or stream valley development. The southern portion of the Yellow Alternative is located east of the ridge alignment and crosses several streams that flow into the Delaware Bay. It is also located in flat topography, except where the alignment crosses steep-sided stream valleys and wetlands. The east-west portions of all alternatives generally follow the shallow grade of the watersheds.

b. Environmental Consequences

The No-Build Alternative would have no effect on the topography of the project area. The build alternatives (Yellow, Brown, Purple, and Green) would result in no appreciable gross changes to project area topography. For the most part, the grades of the alternatives would follow the existing grades of the landscape. Minor elevation changes would be made to the terrain to facilitate road drainage as well as interchange/overpass construction.

2. Geology

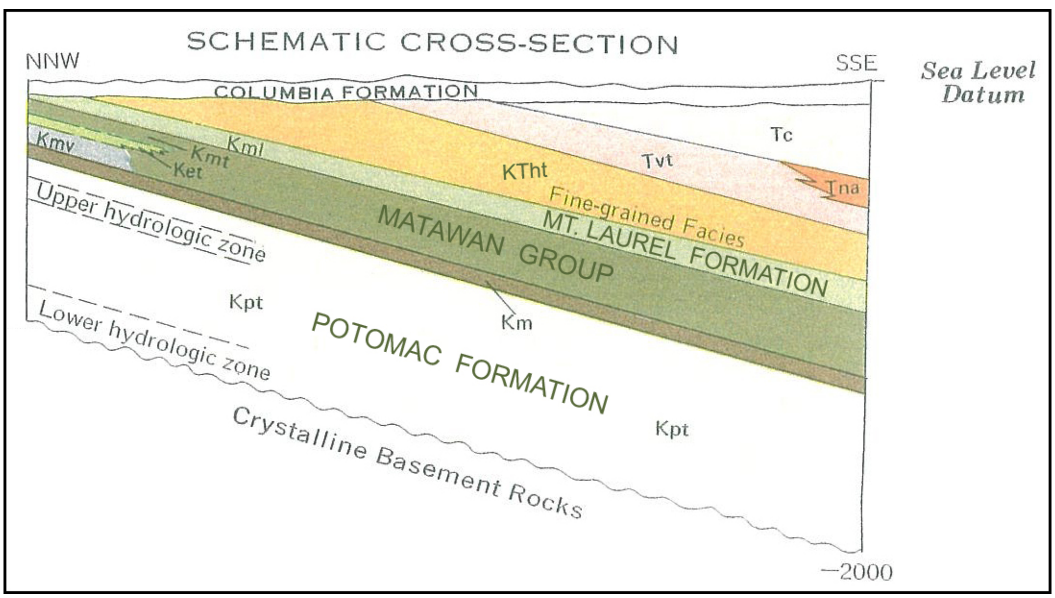
a. Existing Conditions

Geological data were obtained through maps from the Delaware Geological Survey and the University of Delaware. Information obtained includes geologic formations exposed at ground surface and encountered in representative well logs throughout New Castle County. The geology of the project area is shown on ***Figure III-12A*** and ***Figure III-12B***.

The project area occurs entirely within the Delmarva Coastal Plain physiographic province. The Coastal Plain is typified by sedimentary deposits that dip gently and increase in thickness toward the southeast. The geologic formation that occurs at ground surface across most of the project area is the Pleistocene-age Columbia formation. This formation consists primarily of sands and gravels originating from glacial outwash and extends to depths of 10 to over 100 feet below ground surface. This relatively recent formation covers the eroded surfaces of the older, dipping, Coastal Plain strata.

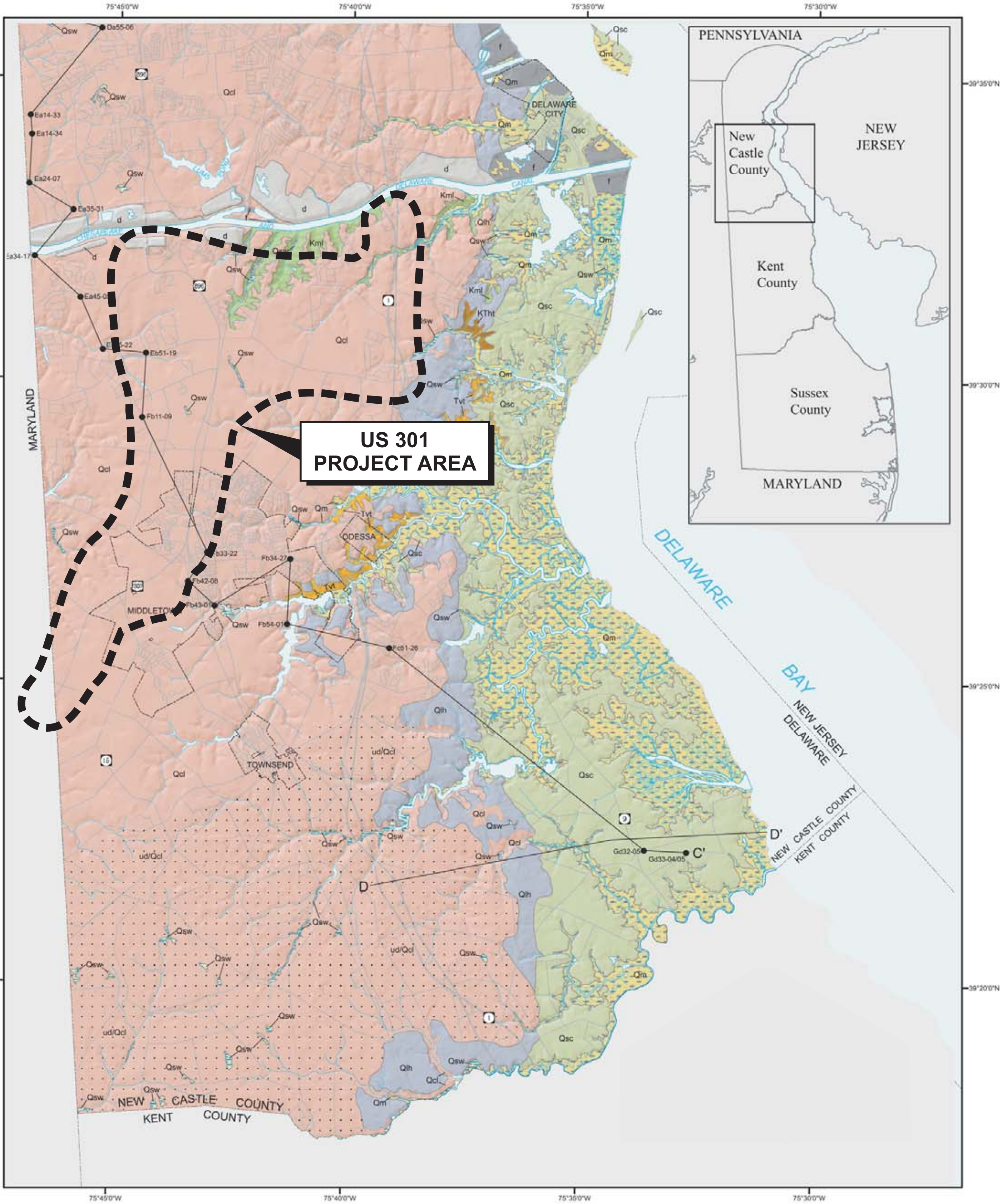
Limited exposures of the older strata within and near the project area, such as the upper Cretaceous-age Mt. Laurel formation, occur in the C&D Canal and some stream valleys draining into the C&D Canal (see ***Figure III-13***). However, the older, dipping strata beneath the Columbia formation underlie extensive areas and form an important series of groundwater aquifers. Even though the Cretaceous and Tertiary-age strata covered by the Columbia formation do not daylight within the project area, groundwater percolating downward through the Columbia likely recharges the deeper aquifers through the truncated surfaces of the dipping strata.

Figure III-13: Generalized Geologic Cross-Section



Source: Geologic Map of New Castle County, Delaware, Delaware Geologic Survey. 2005

Based on the Geologic Map of New Castle County, obtained from the Delaware Geologic Survey, the sedimentary deposits that underlie the near-surface Columbia formation consist of the following significant strata beneath the project area. They are listed from youngest and nearest the surface to oldest and deepest.



Source:
Modified from *Geologic Map of New Castle County, Delaware, 2005,* Delaware Geologic Survey

0 1 2 3 3 5
SCALE IN MILES

Not to Scale

US 301 Project Development

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GEOLOGIC MAP OF PROJECT AREA

Delaware Department of Transportation

August 2006

Figure III-12A

DESCRIPTIONS OF GEOLOGIC MAP UNITS

COASTAL PLAIN

f

Fill
Man-made deposits of natural earth material, including dredge spoil, used to extend shore land and/or to fill a low-lying area such as where a road crosses a valley or marsh. Fill areas include Cherry Island Landfill and Pigeon Point Landfill near Wilmington that were marsh prior to landfill construction. Some construction debris (concrete, bricks, etc.) may be incorporated in the unit.

d

Dredge Disposal Deposits
Located on uplands and consist of dredged material from the Chesapeake and Delaware Canal. Primarily a mixture of sand, silt, and clay from Cretaceous geologic units through which the Canal was cut.

Qsw

Swamp Deposits (Holocene)
Structureless, black to brown, organic-rich, silty and clayey, fine to coarse quartz sand with thin interbeds of medium to coarse quartz sand. Organic particles consist of leaves, twigs, and larger fragments of deciduous plants in stream valleys. In stream valleys, swamp deposits fine upward and grade laterally with salt marsh deposits toward the Delaware River. Defined primarily on the presence of deciduous vegetation in stream valleys (Ramsey, 1997). On uplands, consist of dark- to light-gray clayey silt and very fine to coarse sand. Characterized by areas of seasonally standing water, internal drainage, and hydrophyllic trees. From 1 to 20 ft thick.

Qm

Marsh Deposits (Holocene)
Structureless to finely laminated, black to dark-gray, organic-rich silty clay to clayey silt with discontinuous beds of peat and rare shells (Ramsey, 1997). In-place or transported fragments of marsh grasses such as Spartina are common. Includes some clayey silts of estuarine channel origin. Map area delineated on the distribution of salt-tolerant marsh grasses. Thickness ranges between 1 and 40 ft.

ud/Qcl

Undrained Depression Deposits (upper Pleistocene to lower Holocene)
A belt of upland depressions that stretches across southern New Castle County. Sometimes referred to as Delmarva Bays, are irregular in shape and have internal drainage not integrated with any stream network. Filled with organic-rich woody silts to gray medium to coarse quartz sand (Webb, 1990). Some have a sandy rim at their margins. During wet periods, many are filled with water. Because of the abundance and relative small size (< 500 ft. diameter), individual basins are not mapped; rather, a pattern indicates the extent of these units where they overlie the Columbia Formation. Largest depressions appear as areas of swamp. Radiocarbon dates (Webb, 1990) indicate ages from 11,000 B.P to Recent. Origin is considered by the author to be related to cold-climate periglacial conditions.

Qsc

Scotts Corners Formation (upper Pleistocene)
Heterogeneous unit of light-gray to brown to light-yellowish-brown, coarse to fine sand, gravelly sand and pebble gravel with rare discontinuous beds of organic-rich clayey silt, clayey silt, and pebble gravel. Sands are quartzose with some feldspar and muscovite. Commonly capped by one to two ft of silt to fine sandy silt. Laminae of opaque heavy minerals common. Unit underlies a terrace parallel to the present Delaware River that has elevations less than 25 ft. Interpreted to be a transgressive unit consisting of swamp, marsh, estuarine channel, beach, and bay deposits. Climate during deposition was temperate to warm temperate as interpreted from fossil pollen (Ramsey, 1997). Overall thickness rarely exceeds 15 ft.

Qlh

Lynch Heights Formation (upper Pleistocene)
Heterogeneous unit of light-gray to brown to light yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand. Upper part of unit commonly consists of fine, well-sorted sand. Small-scale cross-bedding within sands is common. Some interbedded clayey silts and silty sands are burrowed. Beds of shell rarely encountered. Sands are quartzose, slightly feldspathic, and typically micaceous where very fine to fine grained. Unit underlies a terrace parallel to present Delaware River that has elevations between 50 and 30 ft. Interpreted to be a fluvial to estuarine unit of fluvial channel, tidal flat, tidal channel, beach, and bay deposits (Ramsey, 1997). Overall thickness rarely exceeds 20 ft.

Qcl

Columbia Formation (middle Pleistocene)
Yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically cross-bedded with cross-sets ranging from a few inches to over three ft in thickness. Scattered beds of tan to reddish-gray clayey silt common. In places, the upper 5 to 25 ft a grayish- to reddish-brown silt to very fine sand overlying medium to coarse sand. Near base of unit, clasts of cobble to small boulder size found in gravel bed ranging from a few inches to three ft thick. Gravel fraction consists primarily of quartz with lesser amounts of chert. Clasts of sandstone, siltstone, and shale from the Valley and Ridge Province, and pegmatite, micaceous schist, and amphibolite from the Piedmont are present. The Columbia fills an eroded surface and ranges from less than 10 ft thick to over 100 ft. Primarily a body of glacial outwash sediment (Jordan, 1964; Ramsey, 1997). Pollen indicate deposition in a cold climate during middle Pleistocene (Groot and Jordan, 1999).

Tvt

Vincentown Formation (Paleocene)
Glauconitic sand that ranges from slightly silty to moderately silty and slightly to moderately clayey. Dominant constituent is subrounded to subangular clear quartz sand that ranges from medium to fine grained. Fine-grained glauconite is a secondary constituent, which ranges from 5 percent in the clayey zones to 15 percent where cleaner. Towards bottom of unit, glauconite percentages increase to about 50 percent of the sand fraction. Silty and clayey zones are thin to thick laminae ranging from 0.01 to 0.5 ft thick. Olive gray to dark-yellowish-brown in zones where iron cement is present. Interpreted to be marine in origin. Rarely occurs in outcrop and is covered by colluvium along the stream valley bluffs where shown on the map. Ranges from 50 to 100 ft in thickness in the subsurface and less than 50 ft thick where it is cut by younger deposits updip.

COASTAL PLAIN (cont.)

KTht

Hornerstown Formation (Upper Cretaceous and Paleocene)
Glauconite sand that is silty and slightly to moderately clayey and contains scattered shell beds. Glauconite approximately 90 percent to 95 percent of the sand fraction and quartz 5 percent to 10 percent. Near the top of unit, silt-filled burrows are present. Lower, the unit is commonly laminated with silty sand and moderately clayey sand. Silt and clay matrix is calcareous. Uniformly a dark-greenish-gray. Interpreted to be marine in origin. The Cretaceous-Tertiary boundary is considered to lie within the formation. Rarely occurs in outcrop and where shown on the map is covered by colluvium along the stream valley bluffs. Ranges between 10 and 50 feet in thickness.

Kml

Mt. Laurel Formation (Upper Cretaceous)
Slightly calcareous, glauconitic, quartz sand that is medium to fine grained. Contains about 3 to 5 percent glauconite. Sand is subrounded to subangular and slightly silty with a few moderately silty zones. Scattered belemnites are present as well as a few scattered shell fragments or thin shell beds. Uniform dark olive gray or yellowish-brown where weathered. In outcrop, reported to be extensively burrowed (Owens, et al., 1970). Where it is the surficial deposit south of the Chesapeake and Delaware Canal, the Mt. Laurel can be confused with the Columbia Formation, especially where the color is similar. Can be differentiated by ubiquitous presence of glauconite and generally better sorted sands of the Mt. Laurel. Marine in origin. Ranges from 30 to 100 ft in thickness.

Kpt

Potomac Formation (Cretaceous)
Dark-red, gray, pink, and white silty clay to clayey silt and very fine to medium sand beds. Beds of gray clayey silt to very fine sand that contain pieces of charcoal and lignite are common. Deposited in a fluvial setting in a tropical to subtropical environment as indicated by abundant paleosol horizons. Ranges from 20 ft updip to over 1600 ft thick in southern New Castle County.

CROSS-SECTION UNITS (not shown on map)

Qus

Quaternary (undifferentiated) *shown on cross-section C-C' only*
Includes the Quaternary surficial units of the Columbia Formation, Lynch Heights Formation, and Scotts Corners Formation. Primarily Sand.

Tc

Calvert Formation (Miocene) *subsurface only*
Gray to grayish-brown clayey silt to silty clay interbedded with gray to light-gray silty to fine to coarse quartz sands. Discontinuous beds of shell are common in the sands and in the clayey silts. The unit ranges up to 100 ft in thickness.

Tsr

Shark River Formation (Eocene) *subsurface only*
Glauconitic clayey silt and clay, with some glauconite sand and fine glauconitic quartz sand. Deposited in the middle Eocene (Benson and Spoljaric, 1996), and is generally 60 to 70 ft thick. Based on the microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Tmq

Manasquan Formation (Paleocene to Eocene) *subsurface only*
Consists of 30 ft of silty, shelly, fine sands that are commonly glauconitic (Benson and Spoljaric, 1996). Deposited during the latest Paleocene to early Eocene (Benson and Spoljaric, 1996). Based on microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Knv

Navesink Formation (Upper Cretaceous) *subsurface only*
Generally a calcareous silt that is slightly to moderately sandy and slightly to moderately clayey. Sand is fine to very fine grained composed of about 50 percent glauconite, 40 percent peloids, and 10 percent quartz. Sediment is laminated, marked by varying amounts of clay and sand. Peloids are yellow to yellowish-brown flat to ovoid pellets that are calcareous and may contain flakes of chitin and grains of glauconite or quartz. Scattered shell fragments are present but form a minor constituent of the sediment. Uniformly dark-greenish-gray, slightly lighter in color than the overlying Hornerstown Formation. 10 to 20 ft thick.

Kmt

Marshalltown Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Greenish-gray, slightly silty, fine-grained glauconitic quartz sand. Glauconite comprises 30 to 40 percent of the sand fraction. Ranges from 10 to 50 ft in thickness. Extensively burrowed. Interpreted to be marine in origin.

Ket

Englishtown Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Light-gray to white, micaceous, slightly silty to silty, fine-grained, slightly glauconitic quartz sand. In outcrop, it is extensively burrowed with Ophiomorpha burrows. Ranges from 20 to 50 ft in thickness. On the cross-section, the Englishtown is shown only where the sands are well developed. Interpreted to be nearshore marine to tidal flat in origin.

Kmv

Merchantville Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Light- to dark-gray, very micaceous, glauconitic, very silty fine- to very fine-grained sand to fine sandy silt. Ranges from 20 to 120 ft in thickness. Marine in origin.

Km

Magothy Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Dark-gray to gray silty clay to clayey silt that contains abundant fragments of lignite; grades downward into a very fine to fine sand with scattered and discontinuous thin beds of clayey silt with lignite fragments. Thickness ranges from 20 to 50 ft. Updip in the vicinity of the Chesapeake and Delaware Canal, the Magothy fills channels incised into the Potomac Formation and is discontinuous in its extent. Interpreted to have been deposited in coastal to nearshore environments.

- Rancocas Aquifer – Formed by the glauconitic, fine sands of the Eocene-age Manasquan and Paleocene-age Vincentown Formations.
- Hornerstown Formation, Paleocene and upper Cretaceous – dark, greenish-gray glauconite sand with a calcareous silt and clay matrix. This formation forms part of the confining bed below the Rancocas aquifer.
- Navesink Formation, upper Cretaceous – Glauconite silt with clay and very fine sand. Also forms part of the confining bed below the Rancocas aquifer.
- Mount Laurel Formation, upper Cretaceous – Includes the Mount Laurel aquifer, which is typified by gray to greenish red-brown, glauconitic, fine to medium quartz sand with some silt.
- Marshalltown Formation, upper Cretaceous – dark greenish gray, massive, highly glauconitic, very silty fine sand. Confining bed above the Englishtown Formation.
- Englishtown Formation, upper Cretaceous – light gray and rust brown, well sorted micaceous, sparingly glauconitic, often “fluffy”, fine sand with thin interbedded layers of dark gray silty sand. Forms a minor aquifer.
- Merchantville Formation, upper Cretaceous – dark gray to dark blue, micaceous, glauconitic sandy silt and silty fine sand; very sticky when wet. Forms a confining bed above the Magothy aquifer.
- Magothy Formation, upper Cretaceous – Dark gray to gray silty clay to clayey silt grading downward into sand. The Magothy aquifer occurs within the lower part of the formation, characterized by discontinuous fine sands thought to represent deposits in channels incised into the underlying Potomac formation.
- Potomac Formation, lower Cretaceous-age – Dark red, white, pink and gray clay interlayered with sand and gravel beds ranging in thickness from 20 feet updip to over 1,600 feet in southeast New Castle County. The Potomac aquifers occur within the sand and gravel strata of the Potomac formation.

The aquifers described above form important ground water supplies for individual, public, and industrial water users. High quality ground water is an important natural resource in Delaware and much of the Atlantic Coastal Plain. The coarse material deposits of the Columbia formation that are good shallow aquifers are also a useful source of exploitable sand and gravel, which are important natural resources in northern Delaware. Greensand (glauconite) from various upper Cretaceous and Tertiary-age formations has been used in the past as fertilizer because it is a source of potash. In New Jersey, glauconite is used in water softening.

The C&D Canal is one of the most prolific fossil locations in the Atlantic Coastal Plain because it cut through and exposed many of these prehistoric sedimentary layers. Most of the outcrops on the beaches below the riprap are fossiliferous but exposed only at low tide.

b. Environmental Consequences

Due to the relative flatness of the project area, only minor excavation is expected with minimal impacts to the local near-surface geologic deposits. The major aquifers are located in the Columbia Formation. The potential impacts to aquifers are discussed further in **Section F.4** of this Chapter. Similarly, since the exploitable sand and gravel deposits are at or near the surface, any roadway construction on these resources would make them unavailable for exploitation.

3. Soils

a. Existing Conditions

Information on soils in the project area was obtained from the US Natural Resources Conservation Service (NRCS), the Soil Survey for New Castle County and GIS soil layers. The soil survey supplied information on soil series and units in the project area. Data pertaining to soil texture, drainage characteristics, erodability, prime farmland and significant soils, and hydric soils are discussed below.

A soil association is a landscape that has a distinctive proportional pattern of soils and normally consists of one or more major soils and at least one minor soil. All project alternatives fall within the Matapeake-Sassafras Association. This association is characterized by nearly level to steep, well-drained soils on uplands. The Matapeake soils have a silt loam surface layer and a silty clay loam subsoil. Sassafras soils have a sandy loam surface layer and a sandy loam and sandy clay loam subsoil.

The United States Department of Agriculture (USDA) NRCS has mapped the soil types that occur within these associations for New Castle County. Thirty-four soil map units occur within the project area representing twelve soil series (***Table III-43***).

Table III-43: Soil Series in Project Area

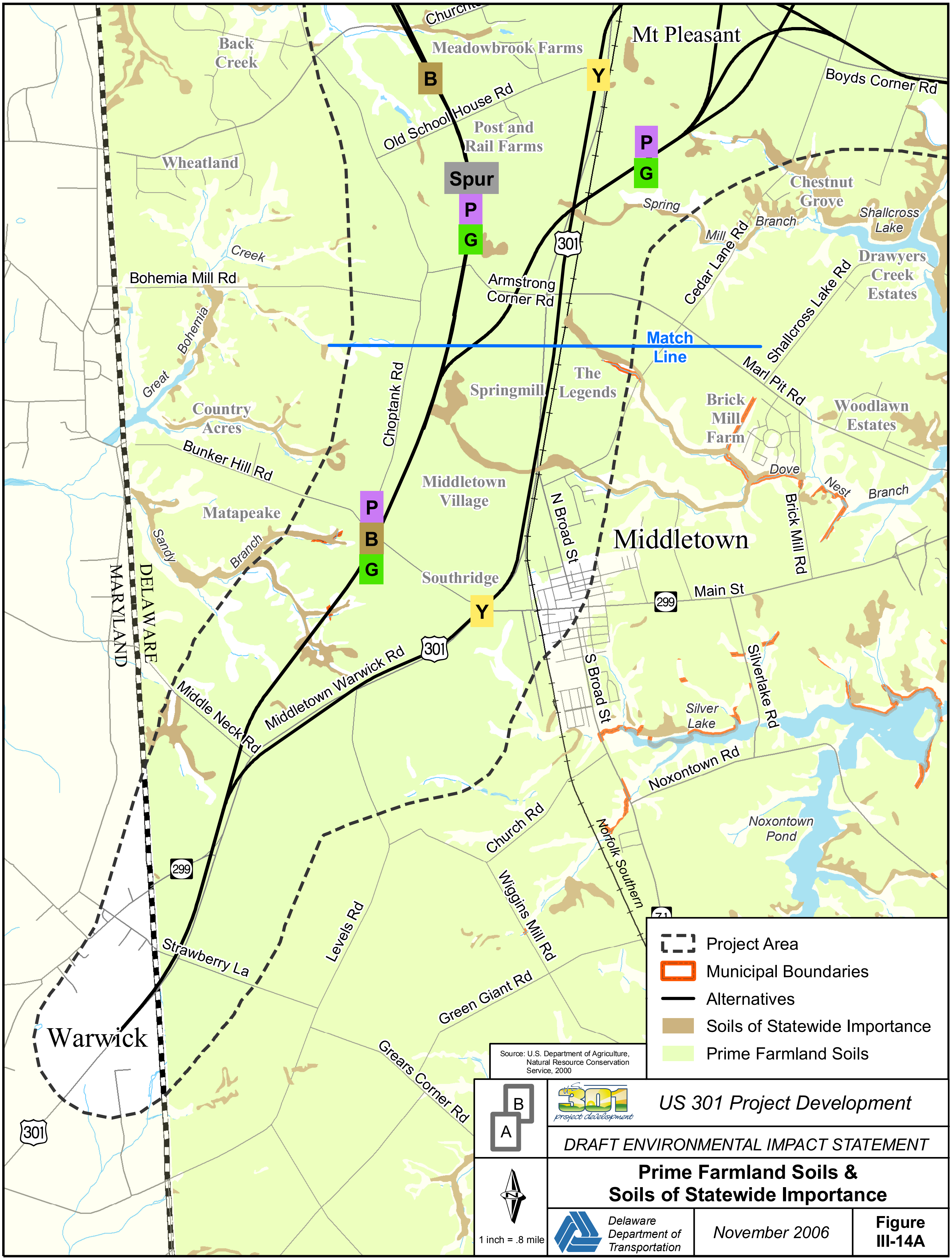
Soil Series - Map Units	USDA Soil Textures	Drainage Characteristics
Butlertown – BuA,BuB2,BuC2	Silt loam	Moderately well drained
Collington – CsC3,CsD3	Fine sandy loam	Well drained
Elkton – EIA,EmA	Sandy loam, silt loam	Poorly drained
Fallsington – Fa,Fs	Sandy loam, loam	Poorly drained
Johnston – Jo	Loam	Very poorly drained
Keyport – KeA,KeB2	Silt loam	Moderately well drained
Made Land - Ma	Varies	Varies
Matapeake -MeA,MeB2,MeC2,MeC3,MeD2, MeD3,MkA,MkB2,MkC2	Silt loam	Well drained
Mattapex – MtA	Silt loam	Moderately well drained
Mixed alluvial Land - Mv	Sand to loam	Poorly drained
Othello – Ot	Silt loam	Poorly drained
Pocomoke – Po	Loam	Very poorly drained
Sassafras SaA,SaB2,SaC2,SaC3,SaD2,SaD3	Sandy loam	Well drained
Sassafras and Matapeake - SmE	Sandy loam, silt loam	Well drained
Tidal Marsh - Tm	Sand to clay	Very poorly drained
Woodstown – WoA,WoB2,WsA,WsB2	Sandy loam, loam	Moderately well drained

The Delaware NRCS local office was contacted to obtain information regarding prime farmland soils and farmland soils of statewide importance in New Castle County. Seventeen of the soil map units are classified as prime farmland soils, nine are considered soils of statewide importance, and nine are hydric soil units. The NRCS maintains a list of soil survey map units that contain hydric soils for New Castle County. Prime farmland soils and Soils of Statewide Importance are shown on ***Figure III-14***.

Prime farmland soils, listed in ***Table III-44***, are soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are also available for these uses. Prime farmland soils typically have an adequate and dependable water supply, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt content, and few or no rocks. They are permeable to water and air, not excessively erodable or saturated with water for a long period of time, and do not flood frequently or are protected from flooding. Soils of statewide importance, listed in ***Table III-45***, are those soils that fail to meet one or more of the requirements of prime farmland, but are important for the production of food, feed, fiber or forage crops. They include those soils that are nearly prime farmland and that economically produce high yields of crops when treated or managed according to acceptable farming methods. Some may produce as high a yield as prime farmlands if conditions are favorable.

Table III-44: Prime Farmland Soils Located Along Project Alternatives

Map Unit	Yellow	Purple	Brown South	Brown North	Green North	Green South
BuA		√	√	√	√	√
BuB2	√	√	√	√	√	√
Fa	√	√	√	√	√	√
Fs	√	√	√	√	√	√
MeA	√	√	√	√	√	√
MeB2	√	√	√	√	√	√
MkA	√	√	√	√	√	√
MkB2	√	√	√	√	√	√
MtA	√	√	√	√	√	√
Ot	√	√	√	√	√	√
Po	√	√			√	√
SaA	√	√	√	√	√	√
SaB2	√	√	√	√	√	√
WoA	√	√	√	√	√	√
WoB2	√	√	√	√	√	√
WsA	√	√	√	√	√	√
WsB2	√	√	√	√	√	√



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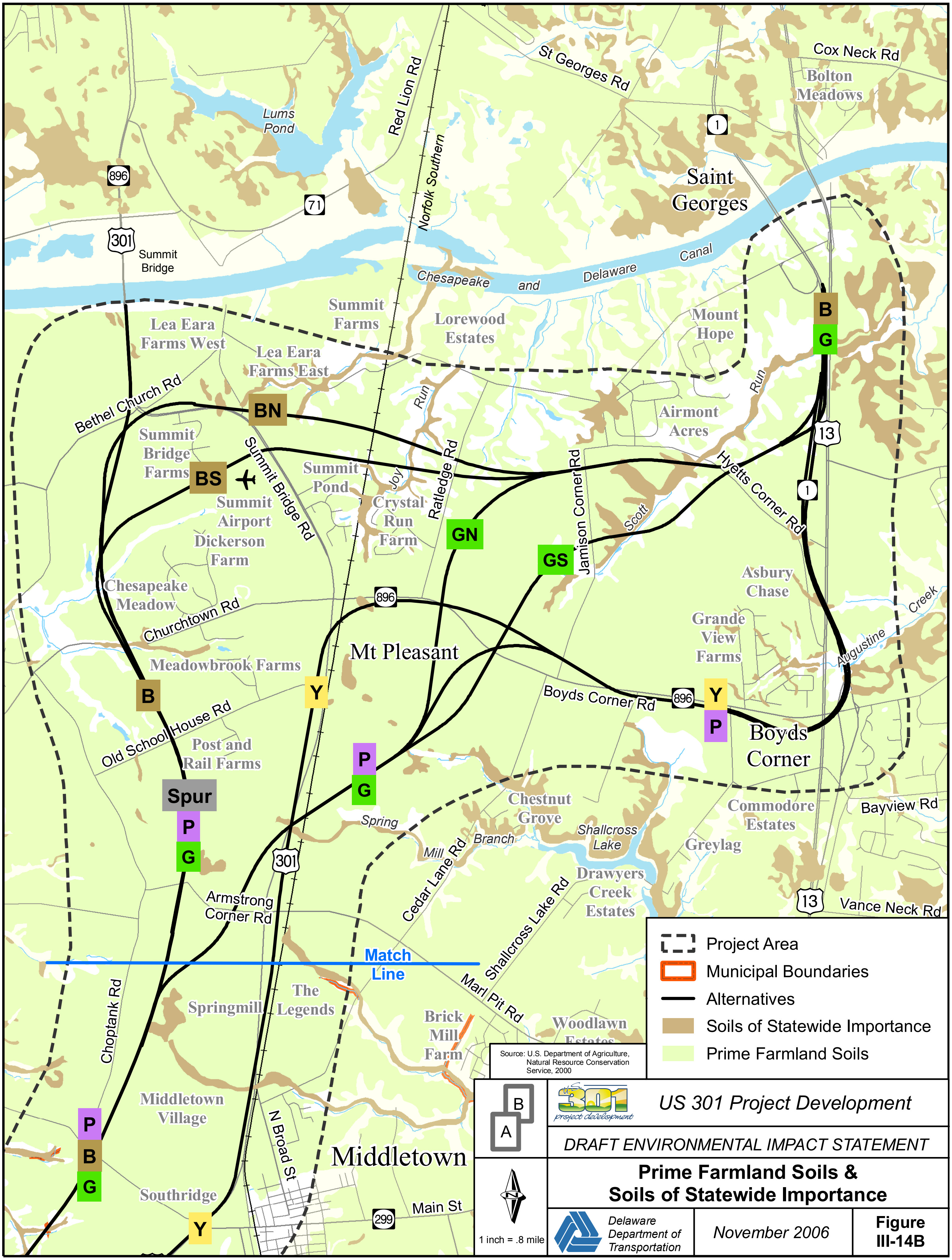
Prime Farmland Soils & Soils of Statewide Importance

November 2006

Figure III-14A



US 301 Project Development

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prime Farmland Soils & Soils of Statewide Importance

Delaware Department of Transportation

November 2006

Figure III-14B

Table III-45: Soils of Statewide Importance Located Along Project Alternatives

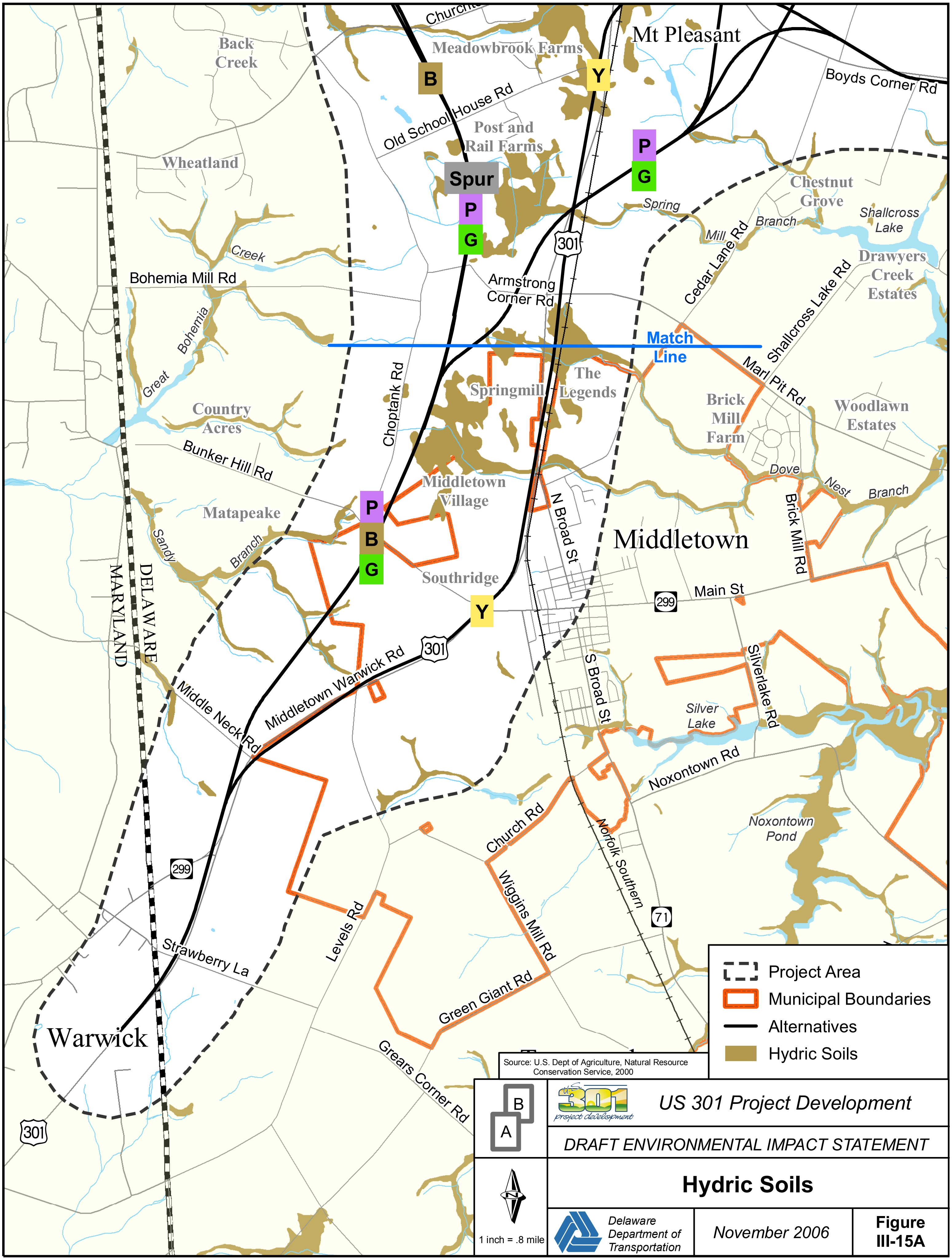
Map Unit	Yellow	Purple	Brown South	Brown North	Green North	Green South
BuC2			√	√	√	√
EIA	√	√	√	√	√	√
EmA	√	√	√	√	√	√
Jo	√	√	√	√	√	√
KeA	√	√	√	√		
KeB2	√	√			√	√
MeC2	√	√	√	√	√	√
MkC2			√	√	√	√
SaC2	√	√	√	√	√	√

Hydric soils are soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Identifying hydric soils is important for land-use planning, conservation planning, and assessment of potential wildlife habitat. Hydric soils in the project area are identified in ***Table III-46*** and shown on ***Figure III-15***.

Table III-46: Hydric Soils Located Along Project Alternatives

Map Unit	Yellow	Purple	Brown South	Brown North	Green North	Green South
EIA	√	√	√	√	√	√
EmA	√	√	√	√	√	√
Fa	√	√	√	√	√	√
Fs	√	√	√	√	√	√
Jo	√	√	√	√	√	√
Mv	√	√	√	√	√	√
Ot	√	√	√	√	√	√
Po	√	√			√	√
Tm			√	√	√	√

Soils encountered along the alternatives have been evaluated for roadway constructability. All soils along the alignment have some limitations for use as a roadway. Limitations include slope, large stones, frost action, wetness, flooding, low strength, depth to bedrock, and shrink-swell. Soils are also rated for their use as a source of roadfill for embankments generally less than six feet high. Along the alignments within the project area, soils received good or fair ratings with the exception of Elkton, Johnston, and Keyport series which received poor ratings.



US 301 Project Development

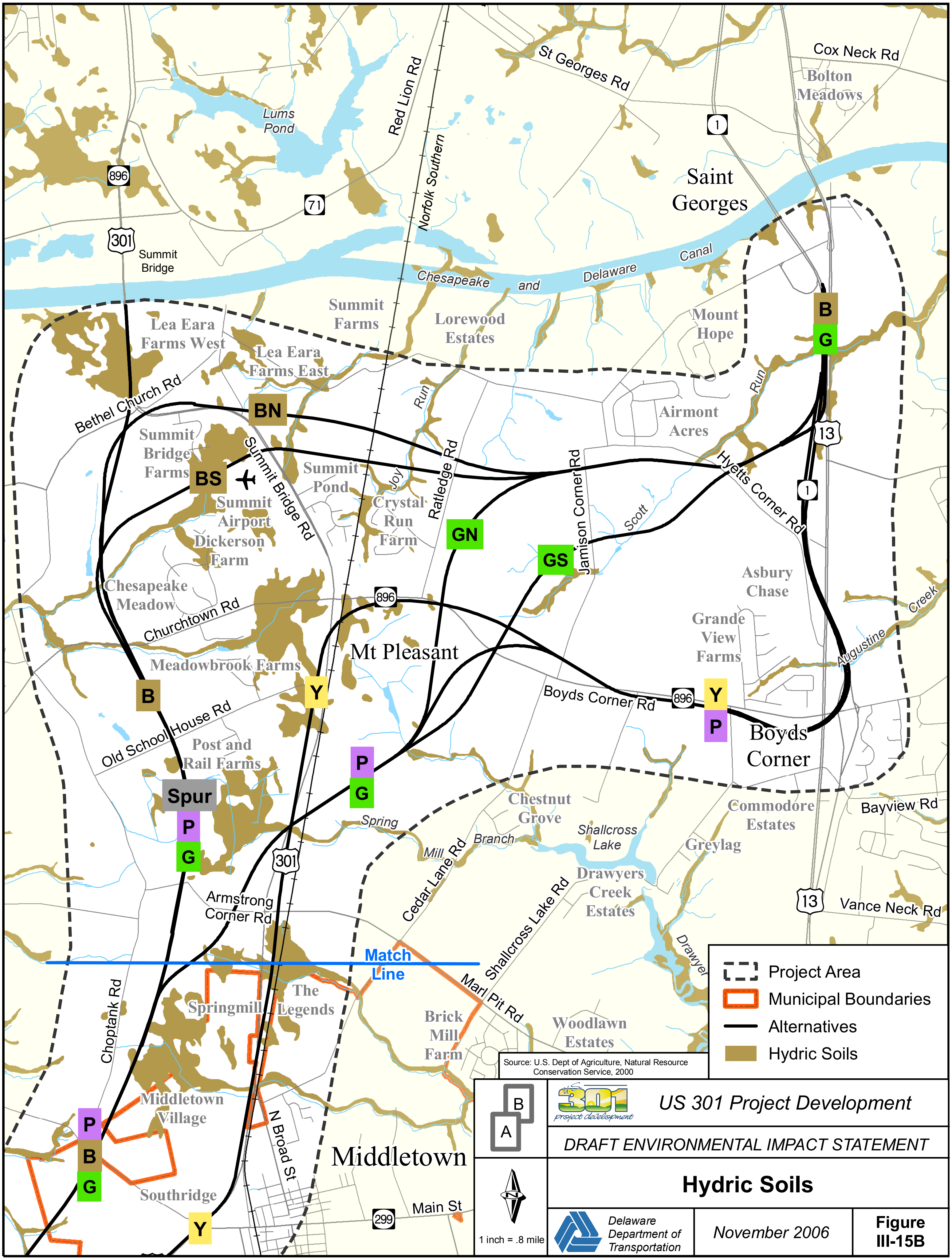
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Hydric Soils

Delaware Department of Transportation

November 2006

Figure III-15A


Cox Neck Rd
Bolton Meadows
St Georges Rd
Lums Pond
Red Lion Rd
Norfolk Southern
Saint Georges
896
71
301
1
Summit Bridge
Chesapeake and Delaware Canal
Summit Farms
Lorewood Estates
Mount Hope
Lea Eara Farms West
Lea Eara Farms East
Bethel Church Rd
BN
B
G
Airmont Acres
Run
13
Summit Bridge Farms
BS
Summit Bridge Rd
Summit Pond
Joy
Crystal Run Farm
Ratledge Rd
Jamison Corner Rd
Scott
Hyetts Corner Rd
Summit Airport
Dickerson Farm
GN
GS
Asbury Chase
Chesapeake Meadow
Churchtown Rd
Grande View Farms
Creek
Augustine
Mt Pleasant
Meadowbrook Farms
Y
B
Boyds Corner Rd
P
Boyds Corner
Old School House Rd
Post and Rail Farms
Spur
Chestnut Grove
Commodore Estates
Bayview Rd
Spring
Shallcross Lake
Branch
Mill
Greylag
Cedar Lane Rd
Drawyers Creek Estates
Armstrong Corner Rd
Shallcross Lake Rd
Vance Neck Rd
Drawyer
Match Line
Marl Pit Rd
The Legends
Springmill
Choptank Rd
Brick Mill Farm
Woodlawn Estates
Middletown Village
N Broad St
Middletown
Southridge
299
Main St
Project Area
Municipal Boundaries
Alternatives
Hydric Soils
Source: U.S. Dept of Agriculture, Natural Resource Conservation Service, 2000
1 inch = .8 mile
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Hydric Soils
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Figure III-15B

b. Environmental Consequences

Impacts to three classes of soils are of concern to the project: prime farmland soils, soils of statewide importance and hydric soils. Each of the alternatives will affect these classes of soils to varying degrees (***Table III-47***). The Farmland Protection Policy Act (FPPA), as amended in 1984 and 1994, includes criteria defining the situations to which the FPPA applies and to which a Form AD-1006 is required. The AD-1006 Farmland Conversation Impact Rating is the form used by federal agencies who wish to convert farmland to nonagricultural uses. Calculations on the form result in a farmland conversion impact rating which assesses the value of farmlands to be converted. This form will be submitted to United States Department of Agriculture during the final planning phase for this project. A one-mile corridor for the selected alternative will be used to evaluate impacts to prime, unique, statewide and locally important farmland soils.

Table III-47: Soils Impacts (Acres)

	No-Build	Yellow	Purple	Brown North	Brown South	Green North	Green South
Prime Farmland Soils	0	203	415	412	424	437	398
Soils of Statewide Importance	0	2	3	4	3	3	3
Hydric Soils	0	158	147	119	115	146	145

Note: Acreage rounded up to nearest whole acre.

The No-Build Alternative would have no impact on soils. Direct impacts to soils related to all other alternatives would result from construction activities such as paving, grading, excavation for stormwater management facilities, and compaction of soils from construction. Grading operations necessary to meet existing roadway grades would result in either the direct removal of soils or their burial under fill. Excavation for stormwater management facilities within the project area would likewise result in the removal or burial of existing soils. Compaction of soils during construction activities could alter soil properties without their removal or burial, and is likely to occur in areas throughout the limit of disturbance.

Additional impacts to the soils would primarily be a result of soil compaction associated with heavy equipment over non-paved areas used during construction and maintenance. Effects of soil compaction could include reduced infiltration rates causing additional surface water runoff or ponding in depressional areas. Both reduced infiltration rates and ponded water could result in changes to the composition of the vegetation community. Ponded water could modify the soil characteristics and result in changes to vegetation from a more upland community to a wetland-species-dominated system. Reduced infiltration rates, combined with more rapid surface water runoff, could also result in a shift in the plant community to species that are more adapted to dry conditions due to the reduction in available moisture (wetland to upland). Other impacts could include root zone impacts, resulting in the mortality of woody vegetation and a shift in animal species relying on pre-construction habitat conditions. In addition, chemicals leaching into soils from general maintenance or accidental spills could impact soil chemistry and vegetation growth. These potential indirect impacts apply to all alternatives.

Impacts to soil resources could be minimized through design and construction techniques. The location of stormwater management facilities could be placed to limit the extent of direct soil impacts. Best management practices during construction (such as the implementation of DNREC-approved erosion and sediment control guidelines, the development of comprehensive grading plans, and the use of sediment and soil stabilization techniques) could greatly minimize soil impacts. A comprehensive replanting effort will be implemented during construction to quickly reestablish vegetative cover for erosion control, and immediately after construction to provide long-term tree and shrub revegetation. While the creation of stormwater management facilities would directly impact some soil resources during construction, they would decrease uncontrolled runoff, widespread erosion on adjacent lands, and provide protection to surface water resources.

4. Groundwater

a. Existing Conditions

Groundwater is an important resource and commodity for the State of Delaware, especially south of the C&D Canal where public surface water supply systems are absent and groundwater is used for both domestic supply and farm irrigation. In addition to domestic and farm water supply, wetland dependant wildlife, including the bog turtle, relies on groundwater to create wetland seep habitat. On average, Delaware receives 40 to 44 inches of local rainfall per year, but not all of this water is available for use. From this yearly rainfall supply, approximately 20 inches evaporates, 3 inches is transpired by plants, and 4 to 5 inches is lost to surface runoff. The remaining 13 to 15 inches makes its way into the ground where it is naturally stored in a system of groundwater aquifers that underlie most of the state.

The Columbia Formation, a relatively thin layer of predominantly sands and gravels that unconformably overlies the older dipping coastal plain sediments presumed to have originated from streams created in the last ice age by melted flowing waters, covers almost all of the Coastal Plain of the state. The Columbia Formation is a groundwater source for water yields ranging from less than 10 gallons per minute (gpm) to excellent water yields greater than 500 gpm where sufficient formation thickness and saturation rates exist. The water yields typically increase in quantity in a general north to south direction, which correlates to formation thickening. This formation also serves a source of recharge for the underlying aquifers.

The Rancocas Group consists of the Vincentown and Hornerstown Formations. These minor aquifers produce well yields adequate for domestic use, but are of little value for large scale water production. The Mount Laurel and the Englishtown Formations, likewise, are capable of producing enough water for domestic use, but are not generally considered to have consistent water supply potential. The Magothy Formation consists of clean sand and it underlies the more recent deposits described above. This aquifer is a major aquifer, but in some areas the depth makes the cost to drill wells prohibitive.

The Potomac Formation is used for water supply in northern Delaware, but not in southern Delaware due to the depth of the aquifer and the groundwater being brackish in nature. Other major aquifer systems that overlie the Potomac Formation are also commonly used.

In the project area, groundwater depths are unusually deeper than what is normal for the Columbia Formation. Vertical recharge is slow even though surface recharge areas cover most of the region; ***Figure III-16*** shows the aquifer recharge areas. There is little to no fluctuation in water levels throughout the year which is most likely due to the presence of the C&D Canal and the surrounding creeks and rivers, particularly Drawyer Creek and its tributaries, located north of Odessa, and the Appoquinimink River and its tributaries, located south of Odessa. These streams and rivers act as natural drains for the water table which dampen any groundwater fluctuation. The following is a summary of groundwater conditions along each of the alternatives:

<u>Yellow Alternative</u>

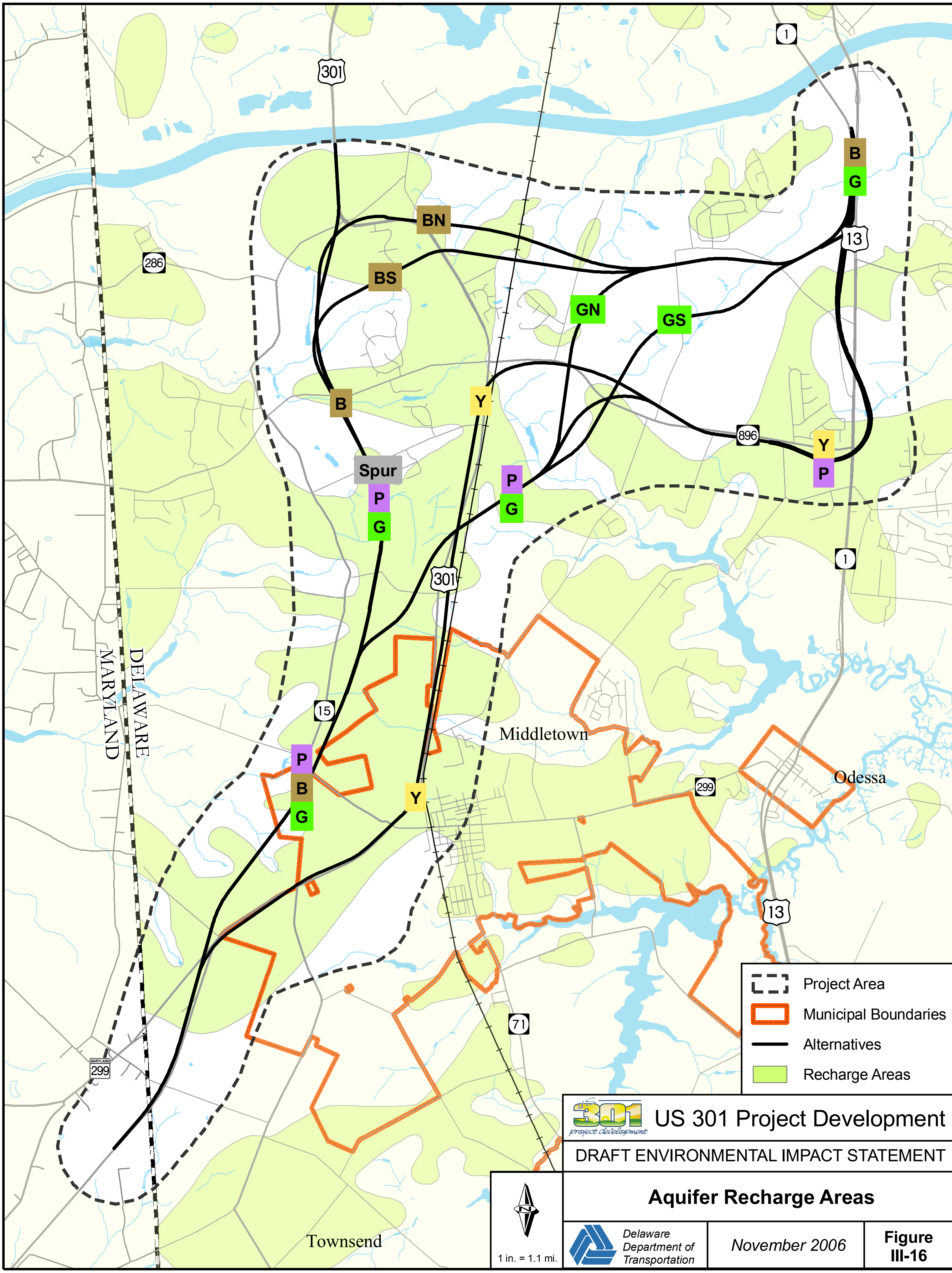
- In the west segment from the state line to about Levels Road, groundwater is present at depths approximately 60 feet or greater becoming as shallow as about 50 feet near Bunker Hill Road and then becoming as deep as 60 feet near Armstrong Corner Road.
- In the mid-section segment, groundwater is present at depths of approximately 40 feet.
- In the east segment from the intersection with SR 896 to the merge with SR 1, groundwater is present at depths ranging from approximately 20 to 40 feet.
- At the Augustine Creek crossing, groundwater is present at depths less than approximately 20 feet below the existing ground surface.
- Approximately 50 percent of the alignment crosses groundwater recharge zones.

<u>Purple Alternative</u>

- In the south end segment from the state line to the merge with SR 896, groundwater is present at depths of approximately 40 to 60 feet.
- At the Sandy Branch crossing, groundwater is present approximately 40 feet or less in depth.
- More than 75 percent of the alignment crosses groundwater recharge zones.

<u>Brown Alternative</u>

- In the south end segment from the state line to Sandy Branch, groundwater is present at depths of approximately 40 to 60 feet. Minor tributaries for Back Creek are located in this segment.
- In the mid-section segment, groundwater is present at depths of approximately 40 feet.
- From the Scott Run crossing to the merge with US 301, groundwater is present at depths less than approximately 20 feet below the existing ground surface.
- Approximately 50 percent of the alignment crosses groundwater recharge zones.



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DRAFT ENVIRONMENTAL IMPACT STATEMENT

Aquifer Recharge Areas

Delaware Department of Transportation

November 2006

Figure III-16

Green Alternative

- In the southwest segment from the state line to about Sandy branch, the depth to groundwater ranges from 40 to 60 feet.
- In the mid-section segment, groundwater is present at depths of approximately 40 to 60 feet; south of Bohemia Mill Road the depth to groundwater becomes as deep as 60 feet.
- In the northeast segment from the crossing with Drawyer Creek to the merge with US 301 the depth to groundwater becomes shallower ranging from 40 to 20 feet, respectively.
- Approximately 40 percent of the alignment crosses groundwater recharge zones.

b. Environmental Consequences

As an unconfined aquifer, the Columbia Formation is vulnerable to contamination from the ground surface. Construction activities involving excavation may encounter and/or affect areas with shallow groundwater depths, especially those located near proposed crossings at bodies of surface water. Any excavations that encounter the groundwater may increase the potential for contamination being introduced into the ground water system. All of the proposed alternatives contain water crossings.

The ground surface areas that have been characterized as recharge zones for the aquifer may also allow for introduction of pollutants into the groundwater through permeation during construction. This is an important concern, considering that a high percentage of the proposed alternative routes are located within the recharge zones. The Purple Alternative has the highest percentage of potential roadway located on recharge zones, followed by the Yellow and Brown Alternatives, then the Green Alternatives.

Introducing impervious surface into groundwater recharge zones may also affect recharge rates and percentage of water infiltration. Decreased infiltration may affect the size and quality of groundwater-created wetland seeps that create habitat for some wetland dependant species.

Once construction of the roadways is complete, it is expected that runoff conditions will develop, possibly causing erosive conditions. Runoff conditions can also introduce undesirable materials, including solid particles and chemicals, into the water table by way of infiltration. Stormwater management facilities and drainage ditches assist in catching much of this runoff; they will be properly designed to prevent groundwater contamination in shallow aquifers.

5. Surface Water and Water Quality

a. Surface Water

Existing Conditions - Watersheds

Five different watersheds are located within the project area, including the C&D Canal East Watershed, C&D Canal West Watershed, Bohemia Creek Watershed, Sassafras River Watershed, and the Appoquinimink River Watershed (***Figure III-17***). Land use within these watersheds includes agricultural, forest, wetland, urban/residential, shrubland, and other undefined land uses. According to DNREC, primary watershed concerns include the presence of pathogens, nutrient loading, physical habitat condition, and protection of water supply.

The Chesapeake & Delaware (C&D) Canal East and West Watersheds

The Chesapeake and Delaware Canal is a man-made navigation channel connecting the Delaware River to the Chesapeake Bay. The C&D Canal East and West Watersheds have a combined drainage area of approximately 41,000 acres. The C&D Canal East Watershed drains into the Delaware Bay Basin, while the C&D Canal West Watershed drains into the Chesapeake Bay Basin.

The C&D Canal East Watershed extends south from the SR 40/Porter Road area to approximately SR 896 and from an area outside the project area on the east to approximately US 301 on the west. The C&D Canal West Watershed extends from SR 40/Porter Road on the north to approximately one mile south of Back Creek, and from the vicinity of US 301 on the east, out of the project area into the State of Maryland to the west.

Major surface water bodies in the C&D Canal East Watershed include the C&D Canal and its unnamed tributaries, Crystal Run, Joy Run, Scott Run and its unnamed tributaries and Augustine Creek. Major surface water bodies in the C&D Canal West Watershed include the Chesapeake and Delaware Canal and its unnamed tributaries and Back Creek and its unnamed tributaries.

Lands adjacent to both watersheds consist of federal reservation land currently designated as a wildlife area. Land use within these watersheds is comprised of 56 percent agricultural, 14 percent forest, 10 percent wetland, 9 percent brushland, 4 percent urban/residential and 7 percent other.

Appoquinimink River Watershed

The Appoquinimink River Watershed drains approximately 30,000 acres within the Delaware Bay Basin in southern New Castle County, Delaware. The Appoquinimink River Watershed extends from the C&D Canal East Watershed on the north to approximately one-half mile south of Wiggins Mill Pond on the south, and from an area outside of the project area on the east to an area slightly east of SR 15 on the west.

Major water bodies within the Appoquinimink River Watershed include the main stem of the Appoquinimink River, Drawyer Creek and its unnamed tributaries, Spring Mill Branch and Dove Nest Branch. Man-made ponds and lakes include Shallcross Lake, Noxontown Lake, Silver Lake and Wiggins Mill Pond.

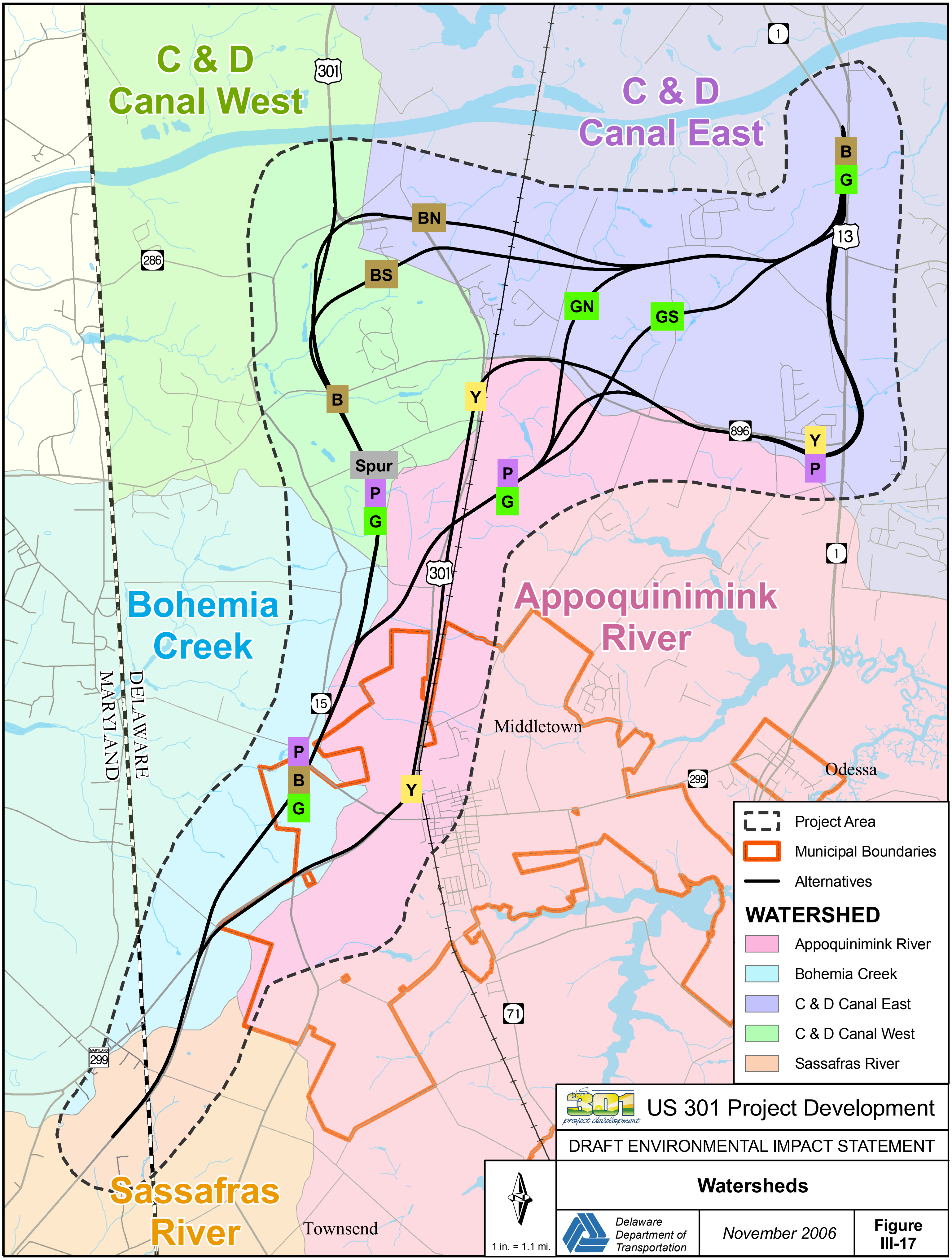
C & D Canal West
C & D Canal East
Bohemia Creek
Appoquinimink River
Sassafras River
MARYLAND
DELAWARE
Middletown
Odessa
Townsend
301
1
13
286
896
15
299
71
BN
BS
B
G
GN
GS
Y
P
Spur
Project Area
Municipal Boundaries
Alternatives
WATERSHED
Appoquinimink River
Bohemia Creek
C & D Canal East
C & D Canal West
Sassafras River
1 in. = 1.1 mi.
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Figure III-17

The major land use category in this watershed is agricultural (69 percent) with the remainder consisting of wetland (12 percent), forest (11 percent), urban/residential (3 percent) and other (5 percent). The area is experiencing significant residential growth near its three residential/urban centers, Middletown, Odessa, and Townsend.

Bohemia Creek Watershed

The Bohemia Creek Watershed drains approximately 12,000 acres of western New Castle County, Delaware and eastern Cecil County, Maryland into the Chesapeake Bay Basin. The Bohemia Creek Watershed is bordered by the C&D Canal West Watershed on the north and extends southward to the Sassafras River Watershed approximately one-half mile south of an unnamed tributary of Sandy Branch. The watershed's eastern boundary is located slightly east of SR 15 and extends to the west, outside of the project area, into the State of Maryland. Major surface water bodies within this watershed include Great Bohemia Creek and its unnamed tributaries and Sandy Branch and its unnamed tributaries.

The major land use category in this watershed is agricultural land with forests, wetlands, and residential areas making up the remaining land uses. Pathogens, nutrient loading, physical habitat condition, and water supply are the primary watershed concerns.

Sassafras River Watershed

The Sassafras River watershed drains approximately 48,300 acres within western New Castle County, Delaware and eastern Cecil County, Maryland. The watershed is bordered by the Bohemia Creek Watershed to the north and extends south, outside of the project area. The watershed's eastern boundary roughly parallels SR 15 and extends westward out of the project area into the State of Maryland.

Major surface water bodies within the Sassafras River Watershed include the Sassafras River and several of its unnamed tributaries.

The major land use categories within the watershed include agricultural (68 percent), forest (26 percent), residential (4 percent) and wetlands (2 percent). Pathogens, nutrient loading, physical habitat condition, and water supply are the primary watershed concerns.

Environmental Consequences

The No-Build Alternative would result in no impacts to watersheds within the project area. Impacts to surface water features could potentially result from construction and operation of each build alternative. These impacts include: bridge and/or culvert construction at stream crossings, accidental spills of hazardous materials, sedimentation, bridge shading, removal of riparian vegetation, surface water diversions, potential dewatering, lack of surface water recharge along stream headwaters and new roadway construction and expansion.

The greatest impact to watersheds within the project area would be from the increase in impervious surfaces created during the construction and expansion of new roadways. A substantial increase in the amount of imperviousness would greatly affect hydrologic conditions including the frequency, intensity and quantity of surface water runoff within the watershed (***Table III-48***). An increase in impervious surface area would also facilitate the introduction of hazardous materials, sediment and erosion into the watershed through increased surface runoff.

Table III-48: Alternatives Impervious Surface Additions

	Yellow	Purple	Brown North	Brown South	Green North	Green South
Acres of Additional Impervious Surface	246	226	217	222	216	220

The most potential impacts would occur during construction and operation of the Yellow Alternative. A total of 38 potential surface water impacts would occur under this alternative. The Purple Alternative and Brown Alternative North Option would have the same number of surface water feature impacts (37). The North and South Options of the Green Alternative have 34 and 33 potential impacts respectively. The Brown Alternative South Option has the least amount of potential impacts with 28.

Table III-49: Potential Impacts to Surface Waters

Alternative		Yellow	Purple	Brown North	Brown South	Green North	Green South
C&D Canal East	Ditches	13	14	2	2	5	5
	Streams	2	2	8	7	6	5
C&D Canal West	Ditches	1	0	7	0	0	0
	Streams	1	0	6	5	0	0
Appoquinimink River	Ditches	7	8	0	0	7	7
	Streams	3	1	0	0	3	3
Bohemia Creek	Ditches	1	2	2	2	1	1
	Streams	0	3	3	3	3	3
Sassafras River	Ditches	6	6	6	6	6	6
	Streams	2	2	3	3	3	3
Total Surface Water Feature Impacts	**Ditches**	**28**	**30**	**17**	**10**	**19**	**19**
	Streams	**10**	**7**	**20**	**18**	**15**	**14**

NOTE: Ditches and Streams are waters of the US not included in wetlands

Construction of bridges or culverts over stream crossings could affect surface water features by altering stream morphology and stream bank stability. Spills of hazardous materials on roadways and during construction may directly enter surface waters. Sediment from construction activities and improper erosion controls after construction may lead to grade changes, and increased erosion in surface waters. Bridge shading and riparian vegetation removal can result in a change to the amount and type of riparian habitat cover and affect water temperature potentially leading to a change in the thermal chemistry of the stream. Surface water diversions could potentially affect stream base flow and increase the possibility of flash flood storm events. Impacts along headwater streams may result in a loss of surface water recharge to a stream system or potential dewatering of headwaters. The construction of new roadways and the expansion of existing road surfaces along surface water features could potentially decrease the amount of vegetated riparian buffer and increase the amount of impervious surface.

Additional impacts to surface water features may occur as a result of activities related to each of the build alternatives including: increased stormwater runoff from impervious surfaces, greater influx of pollutants including sediment into surface water features, temporary disturbance resulting from construction activities, and increased stream velocities and bank erosion rates.

The construction of new road surfaces will increase the amount of impervious surface area within the watershed and also the amount and intensity of stormwater runoff entering surface water features within the project area. The increased traffic on these new roadways may lead to a greater amount of water pollution. Pollutants such as oil, grease, heavy metals, sediment, organics, and nutrients transported from road surfaces via stormwater runoff can be released into nearby streams. During construction activities related to the project, temporary impacts may result due to the disturbance of adjacent land areas and in-stream activities. The disturbance of stream banks and an increase in the amount of runoff can result in a dramatic increase in stream velocities, stream discharge rates, erosion potential and other hydrologic stream functions.

Mitigation options for watersheds that may be used include the construction of stormwater management facilities to handle the increased stormwater runoff that will occur due to more impervious surface areas. These stormwater management facilities manage the flow and discharge of stormwater into the streams and rivers located in the project area and reduce the possibility and effects of increased pollution, erosion, and morphological stream changes. In order to meet the stormwater management requirements for the project, a combination of structural and non-structural stormwater management facilities will be utilized. To the extent practicable, the project will incorporate the use of "Green Technology" Best Management Practices (BMP's) in fulfilling the stormwater management requirements for the project. Green Technology practices include filter strips, biofiltration swales, bioretention, and infiltration trenches. More traditional facilities such as wet and dry ponds will be utilized where the use of Green Technologies are not feasible to meet the stormwater management requirements. Due to right-of-way, utility or environmental constraints, the use of underground stormwater treatment structures, such as filtration structures, hydraulic separators and catch basin inserts may be utilized.

In order to prevent stream degradation, water quality impairment, and flooding associated with construction projects, Delaware's Sediment and Stormwater Regulations require that stormwater management measures (BMPs) be implemented. DNREC has delegated approval authority for stormwater management to DelDOT for DelDOT projects. South of the C&D Canal, runoff must be limited to predevelopment levels for the 2-year and 10-year design storms to prevent flooding and channel erosion, referred to as *quantity* management. To address water *quality* impacts of construction, the runoff from the lesser of the one-year, 24-hour design storm, or one inch, must be treated in BMPs to reduce sediment, nutrient, and toxics loadings to waterways.

Stormwater management BMPs require additional right-of-way and may sometimes need to be located within wetland or other sensitive areas. Therefore, the six alignment alternatives were assessed to determine stormwater management requirements for each, and identify the size and location of potential stormwater management sites, and resulting effects on the project limits of disturbance.

The US 301 roadway typical section includes 4-foot wide side ditches, which, along with the proposed 4:1 side slopes and available safety grading, provide an adequate section for water quality treatment using non-structural BMPs such as bioswales, in keeping with the DNREC preference for ‘green design’ type BMPs. Additional structural BMPs are required for quantity management. Potential SWM pond locations were identified based on topography and proposed roadway horizontal and vertical alignments. Wherever possible, wetlands and historic properties were avoided. Using an adaptation of the methods recommended in Maryland SHA Highway Hydraulic’s Division April 2003 *Stormwater Management Concept Report Guidelines*, the required stormwater pond sizes were estimated as described below:

- Runoff volumes were estimated for the 2-year and 10-year storm events, assuming a Runoff Curve Number of 90 within the roadway cut/fill limits
- Storage volume was estimated for each storm, using 50% of the runoff volume for the 2-year event, and 40% of the runoff volume for the 10-year event, both with a safety factor of 1.3.
- Surface area requirements were computed for each storm, assuming 2 feet of depth for the 2-year volume, and 3 feet of depth for the 10-year volume
- The required pond/structural BMP area was estimated as the larger of the 2-year and 10-year computed surface area, times 1.25

Potential SWM facility locations and sizes are shown in **Appendix B** for all alternatives, along with the project limits of disturbance. Using the method outlined above, the approximate area required for stormwater management facilities would be 7% of proposed area for each alternative.

Bridge construction over surface water features is a minimization method that reduces the amount of impact to a narrow area. By constructing bridges over sensitive features, the amount of impact to adjacent resources can be avoided completely or greatly decreased.

During construction activities, the implementation of best management practices (BMPs) such as limiting the period allowed for instream construction work can reduce potential impacts to streams and watersheds.

Additional mitigation would include riparian buffer restoration. Riparian buffers protect surface waters by reducing thermal impact and attenuating surface runoff. Riparian vegetation would be planted along stream corridors to create new riparian buffers or to enlarge existing undersized buffers.

b. Water Quality

Existing Conditions

The Delaware Water Quality Standards Program has defined "designated uses" for each water body as specified in the water quality standards. Designated use standards require that potential uses of water are protected, even if they are not currently being attained. There are currently nine designated uses of water in the State of Delaware as follows:

- Public Water Supply
- Primary Contact Recreation (Swimming)
- Secondary Contact Recreation (Wading)
- Agricultural Water Supply
- Industrial Water Supply
- Fish Aquatic Life and Wildlife
- ERESE Waters (Waters of Exceptional Recreational and Ecological Significance)
- Cold Water Fish
- Harvestable Shellfish Waters

DNREC has obtained water quality data for several of the surface water features located within the project area (***Table III-50***). Water bodies in this area are routinely monitored for typical water quality parameters (*i.e.*, pH, temperature, dissolved oxygen (DO), etc.). Water quality data for the Sassafras River and Great Bohemia River were not collected by DNREC. DNREC has also conducted habitat and biological assessments of surface water features in the project area. Based upon these assessments, the water quality of these surface water features has been determined to range from severely degraded to excellent.

Surface water quality data reveal that the leading causes of diminished aquatic life uses in Delaware are increased nutrient influx, low dissolved oxygen, and biological and habitat degradation. The main sources of the degradation of biological quality and aquatic habitat are the result of non-point source pollution from agricultural and urban runoff.

Although pathogenic indicators are the most widespread contaminant source found throughout the state, nutrients and toxics pose the most serious threat to surface water quality, aquatic habitat, and human health. Toxic contaminants are released into surface water features as the result of pollution from urban and industrial areas. Non-point sources, primarily runoff from agricultural and urban land, and municipal and industrial point sources remain the primary contributors of both nutrients and toxics to surface water features.

Table III-50: Water Quality Data for Surface Water Features within the Project Area

Watershed	Segment Name	Test Parameters								
		Average DO (mg/L)	DO		pH		Temp		Average Total N (mg/L)	Average Total P (mg/L)
			Maximum	Minimum	Maximum	Minimum	Maximum	Minimum		
C&D Canal (East/West)	C&D Canal from Maryland Line to Delaware River	7.9	11.2	1.9	7.7	6.2	27.0	6.0	2.02	0.157
Appoquinimink River	Lower Appoquinimink River	6.9	10.4	3.6	7.6	6.0	26.0	3.0	1.91	0.304
Appoquinimink River	Upper Appoquinimink River	7.0	9.8	4.0	7.8	6.1	28.0	1.0	2.01	0.204
Appoquinimink River	Drawyer Creek and Tributaries	8.4	11.4	5.0	7.3	6.0	25.0	5.5	2.40	0.266
Appoquinimink River	Shallcross Lake	8.9	11.6	7.6	8.1	5.2	24.0	6.0	3.33	0.051
Appoquinimink River	Silver Lake	9.8	11.9	6.6	8.5	6.2	14.0	5.5	5.15	0.097

Surface waters located in the Appoquinimink River Watershed and C&D Canal East and West Watersheds have shown moderately to severely degraded water quality as a result of pollution from ongoing urban and industrial runoff and prior contamination. Surface water features located in more rural areas, including the Bohemia Creek and Sassafras River Watersheds, exhibit more stable water quality compared to other watersheds in the project area and have water quality impacts primarily from agricultural use.

DNREC, in response to surface water quality degradation, has established fish consumption advisories to the general public for portions of the Appoquinimink River, Drawyer Creek and its tributaries, and the C&D Canal.

Environmental Consequences

Impacts to surface water quality may result from each of the build alternatives. Only the No-Build Alternative would result in no impacts to surface water quality. Direct impacts that result from bridge or roadway construction or those involving the disturbance of stream banks or channels will have an adverse impact on water quality by affecting stream flow rates, temperature and nutrient levels. Elevated levels of pollutants such as oil and grease, deicers, heavy metals, organics, sediment and nutrients will accompany increased stormwater runoff from vehicle traffic using these routes.

An increase in impervious surface area will provide a direct means for the introduction of increased levels of hazardous materials, sediment and excess nutrients into surface water bodies. New impervious areas introduced into each watershed will also inhibit the dilution of pollutants and sediment loads by surface and subsurface soils which otherwise could reduce the negative affects of pollutants and sediment loads on water quality.

The construction of roadways and adjacent development will include the introduction of additional discharge outlets (*i.e.*, pipes and culverts) for the transmission of polluted runoff from both point and non-point sources. The increased number of discharge points will have a negative affect on the overall surface water quality within the project area.

Construction activities that occur adjacent to or within the vicinity of surface water features may have effects on surface water features. The construction of new roads, drainage ways, and other impervious surfaces will increase the amount of stormwater runoff entering nearby rivers, streams and lakes. The construction of new transportation routes may result in further land development and promote additional land use changes throughout the project area to address demand for more commercial and residential properties. The clearing and excavation of previously forested or agricultural lands may cause an increase in soil erosion and lead to further sedimentation of surface water features. Similarly, reductions in riparian forest may lead to elevated water temperatures which is directly limiting to cold-water fishes, and decreases dissolved oxygen limiting to all aquatic life.

<u>Mitigation</u>

Properly designed and constructed stormwater management facilities will control the release and amount of runoff entering natural surface water features from newly created highways and drainage ways and reduce the potential for sedimentation impact to receiving waters. In order to obtain proper avoidance and minimization of impacts to surface water quality, the design and construction of each stormwater management facility will be in conformance with the requirements established by DNREC.

During construction activities, the implementation of BMPs will reduce potential negative effects by providing a standard control method that meets the highest degree of pollution reduction possible. The design and construction of routes to limit direct impacts to surface water features will reduce the level of impact to the natural system. In areas of temporary disturbance owing to construction, soil and vegetative cover will be reestablished to return disturbed areas to their natural appearance and function.

Proper erosion and sediment control measures will be employed as a BMP to limit the amount of erosion and the influx of sediment loads into adjacent surface waters. The implementation of these practices during roadway construction will further provide for the protection of water quality within the project area. To ensure proper construction and maintenance, erosion and sediment control measures will be installed in adherence with the requirements of DNREC and be subjected to the examination and authority of DNREC inspectors.

Additional mitigation would include riparian buffer restoration. Riparian buffers improve water quality by reducing thermal impact leading to increased oxygen levels and by attenuating surface runoff reducing erosion and partially filtering pollutants and contaminates. Riparian vegetation would be planted along stream corridors to create new riparian buffers or to enlarge existing undersized buffers.

6. Waters of the United States, including Wetlands

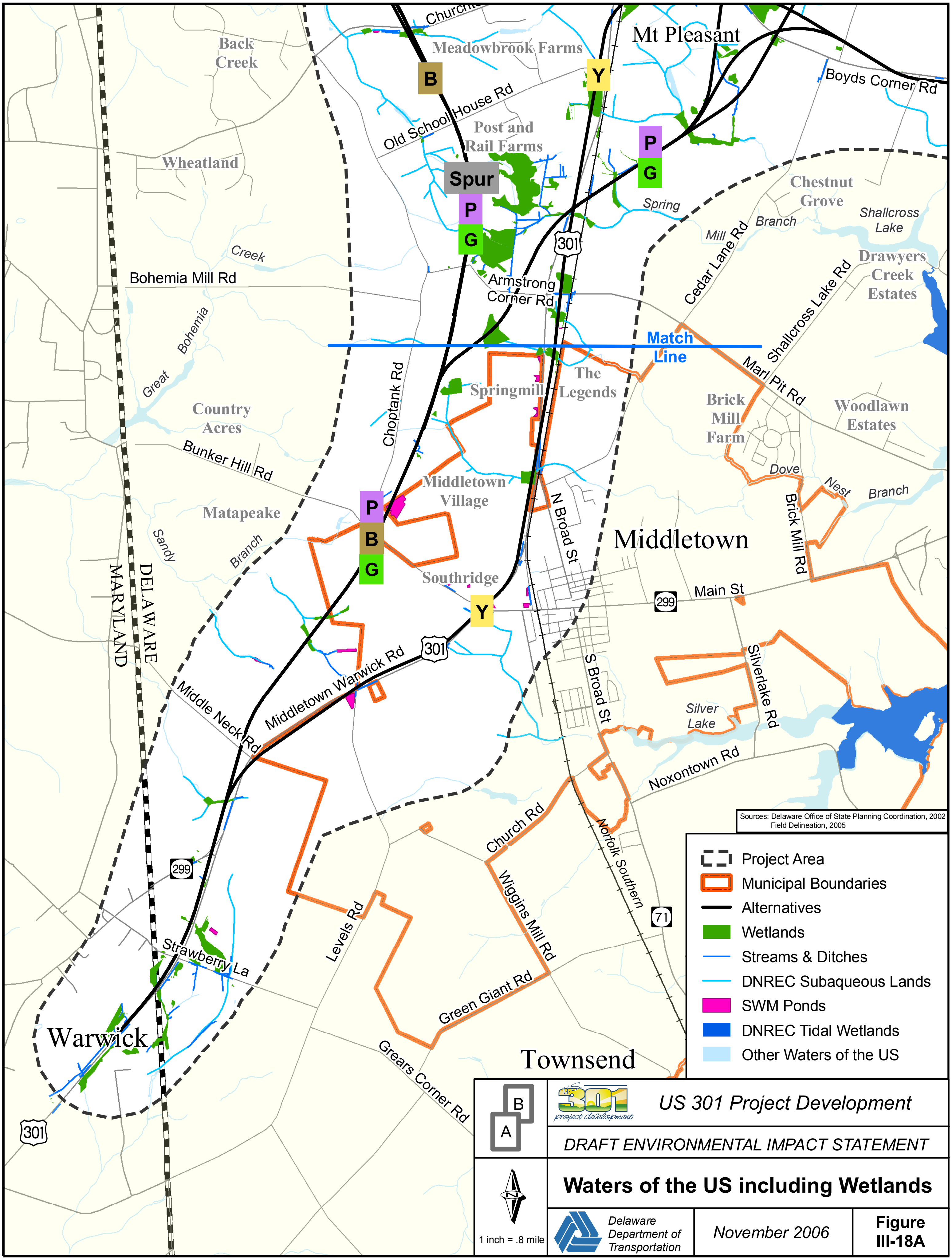
a. Existing Conditions

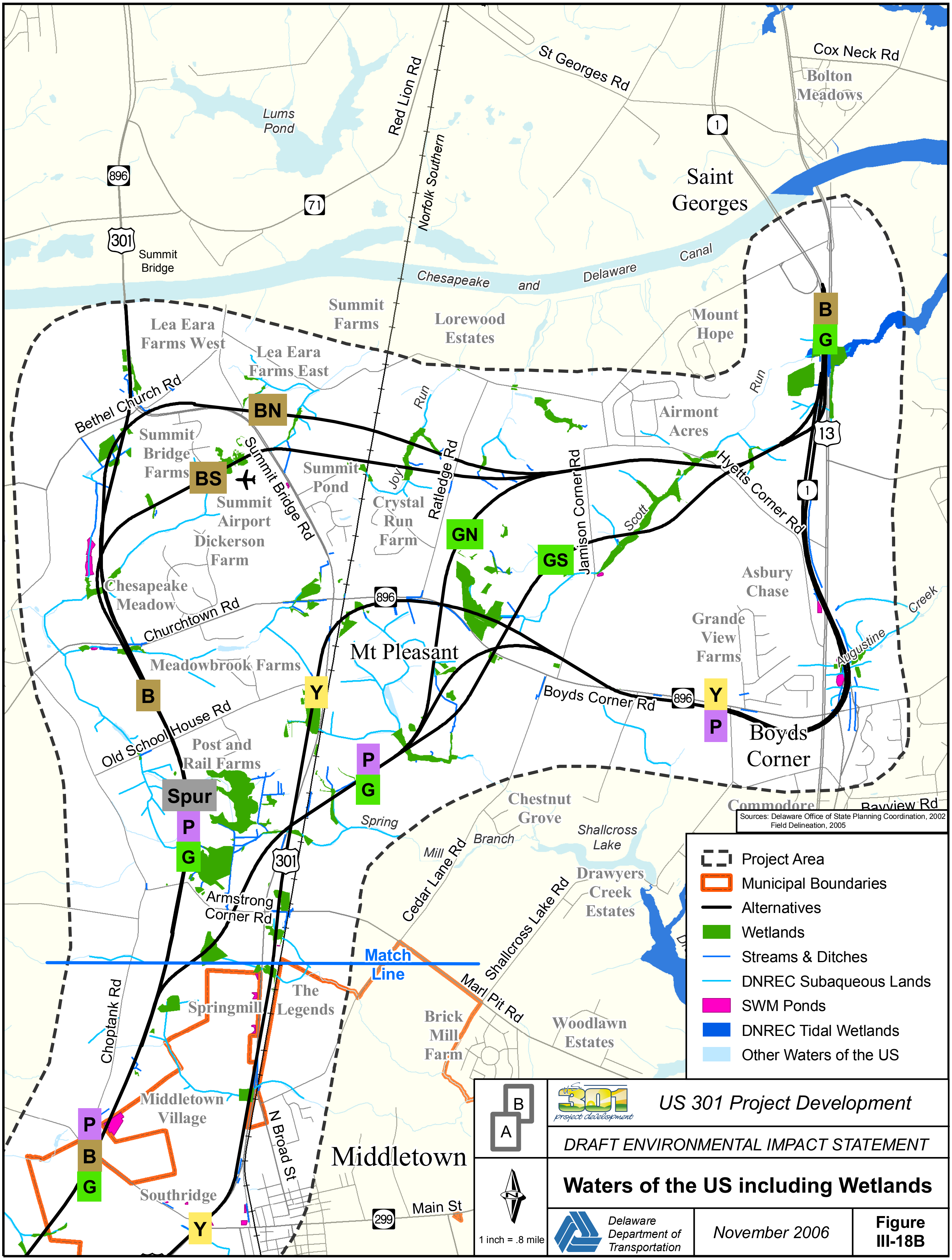
This section includes two areas of study: the *wetland investigation area* and the *project area*. The wetland investigation area is based on a buffer around the potential impact areas. The project area includes a larger area extending beyond the limit of disturbance (LOD) and wetland investigation area for the purpose of more generalized analysis of other cultural, socioeconomic, and natural features. A thorough evaluation of the wetland investigation area can be found in the *US 301 Project Development: Investigation for Wetlands and Waters of the United States and Phase 1 Bog Turtle Habitat Assessment, 2005* (draft, November 2005).

Delaware Office of State Planning and Coordination 2002 GIS Land Use and Land Cover wetlands data were used, in conjunction with Delaware 2002 aerial photography, to initially determine the presence of wetlands greater than one-quarter acre within the wetland investigation area. In addition, three previous wetland delineations were referenced: one for the Whitehall Properties development project carried out in 1998 and provided by Whitehall Joint Venture, the February 2000 delineation for the Village of Bayberry development and a recent delineation for the Pleasanton development. Information on hydric soils was compiled from NRCS and DDA mapping files; detailed soils information can be found in **Section F.3** of this Chapter.

Some wetlands assessed during field investigations contain water features within the wetland boundary, such as streams within a wetland corridor or a drainage ditches within a forested wetland tracts. These water features were not identified separately from the surrounding wetland at this time and will be delineated and surveyed as separate resources for permitting following selection of an alternative. This method of grouping as one wetland feature, approved by USACE, DNREC, and EPA, was done to streamline alternative assessment.

The detailed investigation was conducted according to the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) using the routine on-site method and supplemental guidance issued by the US Army Corps of Engineers (ACOE). The ACOE manual outlines a three parameter approach to delineating wetlands. All three parameters (hydrophytic vegetation, hydrologic indicators, and hydric soils) must be evident for an area to be considered a wetland, unless the site has been disturbed or is considered a problem area. The wetlands identified during the investigation are shown in general on ***Figure III-14*** and in detail in **Appendix B**. Hydric soils are shown on ***Figure III-15***.


Mt Pleasant
Meadowbrook Farms
Back Creek
Boyds Corner Rd
Old School House Rd
Post and Rail Farms
Wheatland
Spur
Spring
Chestnut Grove
Shallcross Lake
Mill
Branch
Creek
Drawyers Creek Estates
Bohemia Mill Rd
Armstrong Corner Rd
Cedar Lane Rd
Shallcross Lake Rd
Bohemia
Great
Match Line
The Legends
Springmill
Marl Pit Rd
Country Acres
Choptank Rd
Brick Mill Farm
Woodlawn Estates
Bunker Hill Rd
Dove
Nest
Branch
Middletown Village
Matapeake
N Broad St
Brick Mill Rd
Sandy
Branch
Middletown
MARYLAND
DELAWARE
Southridge
Main St
299
301
Middletown Warwick Rd
S Broad St
Silverlake Rd
Middle Neck Rd
Silver Lake
Noxontown Rd
Church Rd
Norfolk Southern
Sources: Delaware Office of State Planning Coordination, 2002
Field Delineation, 2005
Levels Rd
Wiggins Mill Rd
71
Strawberry La
Green Giant Rd
Warwick
Townsend
Grears Corner Rd
Project Area
Municipal Boundaries
Alternatives
Wetlands
Streams & Ditches
DNREC Subaqueous Lands
SWM Ponds
DNREC Tidal Wetlands
Other Waters of the US
US 301 Project Development
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Waters of the US including Wetlands
1 inch = .8 mile
Delaware Department of Transportation
November 2006
Figure III-18A



US 301 Project Development

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Waters of the US including Wetlands

November 2006

Figure III-18B

Each identified wetland was given a quality rating of high, medium, or low. The quality rating was based on the individual wetland delineator's best professional judgment. The following functions and values were considered when determining wetland quality: groundwater recharge and discharge, flood flow alteration, fish and shell fish habitat, sediment toxicant retention, nutrient removal, production export, sediment and shoreline stabilization, wildlife habitat, recreation, education and scientific value, uniqueness and heritage, visual quality and aesthetics, endangered species habitat and size. Most of the wetland quality ratings have not been reviewed by the regulatory agencies; however, several wetlands and their qualities were reviewed in the field with the ACOE. In addition the quality ratings of a few of the wetlands along the Yellow alignment were reviewed in the field with both DNREC and the ACOE.

Ephemeral, intermittent, and perennial waters of the US not surrounded by wetlands were also surveyed. Information on feature hydrologic class, feature description, average width and depth, bottom substrate, and vegetation was collected during the field investigation.

Twelve field reviews with the ACOE (June 15, June 23, July 12, July 19, August 9, August 19, September 8, November 9, November 16, and December 21, 2005; January 5 and January 10, 2006) have been completed for all wetland and waters boundaries for the four build alternatives. DNREC representatives attended many of these meetings as well (see **Chapter IV B.2** and **3**). These field reviews consisted of the wetland delineation team visiting delineated resources with a representative of ACOE and adjusting wetland boundaries if necessary.

Wetlands within the wetland investigation area are mostly linear riparian systems associated with stream drainage, or irregular shaped depressions where the water table is close to the surface or surface drainage is poor. The portion of the project area south of Summit Airport and Boyds Corner, including the Brown, Purple, Yellow, and Green alternatives, is situated along the Chesapeake Bay/Delaware River drainage divide and thus in the upper reaches of the watersheds. In these areas, the streams are generally small, with little development of floodplains or stream valleys. There are two types of wetlands in these areas: large, forested wetlands surrounded by agricultural fields or narrow wetlands along ditched or small, straightened streams.

The investigated area north and east of the Summit Airport and Boyds Corner, including portions of the Yellow, Purple, Green, and Brown alternatives, intersects large, well-developed floodplain and wetland corridors along Scott Run and Joy Run. There are also a few flat, forested wetlands immediately east of Boyds Corner.

Tax Ditches

Under Delaware Code Chapter 14, tax ditch organizations are legal entities and subsidiary units of state government, with taxation powers, established by Superior Court order to provide for ownership, construction, and maintenance of tax ditches. Tax ditches are man-made channels, constructed for the purposes of flood control and agricultural drainage. A tax ditch organization is comprised of all landowners (referred to as taxables) of a particular watershed or sub-watershed, and overseen by managers and a secretary/treasurer, elected annually from among the taxables. DNREC's Division of Soil and Water Conservation, Drainage Section, provides technical assistance to the organizations in the review of any proposed changes to ditch flow patterns or drainage boundaries. The organizations have the authority to prevent additional lands and waters from draining into tax ditches. DelDOT is required to maintain highway drainageways to prevent sediment from obstructing tax ditches to the extent possible and to remove obstructing sediment and silt from tax ditches near highways. Tax ditches are also subject to regulation as waters of the US, when so delineated, and as non-delineated floodplains, when shown on the appropriate Soil Survey or USGS quadrangle maps.

b. Environmental Consequences

This section describes potential impacts to wetlands and waters resulting from the four build alternatives and their options. Impacts were calculated based on LOD defined for each alternative. In areas where grading changes are significant, the LOD is located 25 feet beyond the proposed toe of slopes. Where a bridge spans an environmental resource, the LOD was defined as the footprint of the bridge (i.e., the "shaded" area).

Wetland impacts include the displacement or filling of an entire wetland or a portion of a wetland. Impacts include an interruption to wetland hydrology or interruption to the hydrology of a stream. Additional impacts can result from roadway runoff, sedimentation, alterations to hydrology and shadows cast by bridge structures. Some of these impacts could lead to degradation or a decrease in an available wetland and waterway habitat within the project area and, ultimately, a decrease in plant and animal species inhabiting these areas. These impacts are regulated under the Clean Water Act (CWA) Sections 404 and 401, and associated DNREC and Maryland Department of the Environment (MDE) requirements.

The No-Build Alternative would not affect any wetlands or other waters of the US. The build alternatives would affect wetlands and other waters of the US to varying degrees described below and in ***Tables III-51*** and ***III-52***.

Table III-51: Potential ACOE and DNREC Jurisdictional Impacts

Resource	Yellow	Purple	Brown North	Brown South	Green North	Green South
Total Potential ACOE Wetlands Impacts[1] (acres)	50.5	24.9	23.9	18.5	26.2	28.3
High Quality Wetlands	8.6	7.6	11.5	9.9	9.0	9.6
Medium Quality Wetlands	30.6	13.2	4.2	7.3	13.2	13.6
Low Quality Wetlands	11.2	4.2	8.2	1.3	4.0	5.1
Number of Wetlands Impacted	33	45	39	35	43	40
Number of Wetland Crossings	4	9	10	8	8	8
Number of wetlands with complete fragmentation	7	6	3	4	6	7
ACOE other waters of the US, Streams[2] (linear feet)	215	260	921	1,895	327	521
ACOE other waters of the US, Ditches (linear feet)	20,492	15,997	14,237	12,383	15,188	15,805
ACOE other waters of the US, Open Waters (ponds, SWM) (acres)	3.4	3.2	3.2	5.8	3.2	3.2
DNREC Tidal Wetlands[3] (acres)	0.4	0.4	0.4	0.4	0.4	0.4
DNREC Subaqueous Lands[4] (linear feet)	7,167	6,461	7,885	8,232	8,162	8,481

1. Wetlands are based on field delineations by GPS. Wetlands boundaries have be verified by ACOE.
2. Includes streams field delineated by GPS. This does not include stream segments within wetlands.
3. Tidal wetlands are based on DNREC's Delaware Tidal Wetland Delineation Maps.
4. Subaqueous Lands based on Streams shown on USGS quad maps and on New Castle County Soil Survey

Table III-52: Individual Wetlands Impacts of the Alternatives

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
11B	PEM/PFO	Palustrine Mixed	Medium	11,671	2.88										
14F	PFO	Palustrine Forested	High	220	0.05	217	0.05								
14I	PEM/PSS	Palustrine Mixed	Medium	209	0.05	204	0.05								
14L	PEM	Palustrine Emergent	Low	1,609	0.40	1,586	0.39								
16B	PFO	Palustrine Forested	High			245	0.06	239	0.06	239	0.06	245	0.06	245	0.06
16C	PFO	Palustrine Forested	High			37	0.01	34	0.01	34	0.01	37	0.01	37	0.01
17AA	PEM	Palustrine Emergent	Medium			21,856	5.40					21,856	5.40	21,856	5.40
18D	PFO	Palustrine Forested	Medium			33	0.01					33	0.01	33	0.01
19B	PFO	Palustrine Forested	Medium			312	0.08					889	0.22		
19C	PEM	Palustrine Emergent	Low			1,669	0.41					1,830	0.45		
1B	PEM/PFO	Palustrine Mixed	Medium	1,843	0.46	1,852	0.46	1843	0.46	1,843	0.46	1,852	0.46	1,852	0.46
1F	PFO	Palustrine Forested	High	4,222	1.04	4217	1.04	4222	1.04	4,222	1.04	4,217	1.04	4,217	1.04
1H	PFO	Palustrine Forested	High	437	0.11	443	0.11	437	0.11	437	0.11	443	0.11	443	0.11
1L	PFO	Palustrine Forested	High	117	0.03	117	0.03	117	0.03	117	0.03	117	0.03	117	0.03
1M	PFO	Palustrine Forested	High	193	0.05	181	0.05	193	0.05	193	0.05	181	0.05	181	0.05
1R	PEM/PSS	Palustrine Mixed	Medium	730	0.18	730	0.18	730	0.18	730	0.18	730	0.18	730	0.18

Table III-52: Individual Wetlands Impacts of the Alternatives

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
1S	PEM/PSS	Palustrine Mixed	Medium	569	0.14	569	0.14	569	0.14	569	0.14	569	0.14	569	0.14
1T	PEM/PSS/ PFO	Palustrine Mixed	High	1,213	0.30	1,206	0.30	1207	0.30	1,207	0.30	1206	0.30	1,206	0.30
1U	PEM	Palustrine Emergent	Medium	1,037	0.26	1,037	0.26	1,037	0.26	1,037	0.26	1,037	0.26	1,037	0.26
20O	PEM	Palustrine Emergent	High	5,731	1.42										
20Q	PEM	Palustrine Emergent	Low	8,171	2.02										
20S	PEM	Palustrine Emergent	Medium	86	0.02										
21B	PEM	Palustrine Emergent	High			7,468	1.85	5,394	1.33	6934	1.71	7,468	1.85	7,468	1.85
21c	PFO/PEM	Palustrine Mixed	Medium			500	0.12	489	0.12	489	0.12	500	0.12	500	0.12
21F	PFO/PEM	Palustrine Mixed	Medium			434	0.11	440	0.11	440	0.11	434	0.11	434	0.11
22B	PFO	Palustrine Forested	High			2,995	0.74	5,521	1.36	5,310	1.31	2,995	0.74	2,995	0.74
22C	PFO	Palustrine Forested	Medium							4,738	1.17				
23E	PFO	Palustrine Forested	Low	469	0.12	985	0.24	1,105	0.27	845	0.21	985	0.24	985	0.24
23F	PFO	Palustrine Forested	Medium					1,625	0.40	130	0.03				
23G	PEM	Palustrine Emergent	Low			656	0.16	3,034	0.75	1,364	0.34	656	0.16	656	0.16
23H	PEM	Palustrine Emergent	Low					2,554	0.63	862	0.21				
23S	PFO	Palustrine Forested	Medium	2,055	0.51	8,572	2.12	3,563	0.88	499	0.12	8,572	2.12	8,572	2.12
23T	PFO	Palustrine Forested	Low	1,520	0.38	4,332	1.07	2,455	0.61	2,067	0.51	4,332	1.07	4,332	1.07

Table III-52: Individual Wetlands Impacts of the Alternatives

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
23U	PEM	Palustrine Emergent	Low			1,302	0.32	1,741	0.43			1,302	0.32	1,302	0.32
23V	PEM	Palustrine Emergent	Low			5,309	1.31	973	0.24			5,309	1.31	5,309	1.31
23W	PEM	Palustrine Emergent	Low			354	0.09	21,364	5.28			354	0.09	354	0.09
24D	PFO	Palustrine Forested	High					2,565	0.63	287	0.07				
25A	PEM	Palustrine Emergent	High					5,395	1.33						
26B	PEM	Palustrine Emergent	High					2,803	0.69						
28A	PFO	Palustrine Forested	High					3,975	0.98	3,911	0.97	3,638	0.90	1,541	0.38
28B	PEM/PFO	Palustrine Mixed	Medium					2,026	0.50	2,026	0.50	2,027	0.50	2,041	0.50
29D	PEM	Palustrine Emergent	Medium	694	0.17	657	0.16	845	0.21	845	0.21	830	0.21	830	0.21
29E	PEM/PFO/ PSS	Palustrine Mixed	High	2,098	0.52	2,044	0.51	4,032	1.00	4,032	1.00	3,940	0.97	3,940	0.97
2C	PEM/PSS	Palustrine Mixed	High	2,143	0.53	180	0.04	181	0.05	181	0.05	180	0.04	180	0.04
2D	PEM	Palustrine Emergent	Low	226	0.06										
2E	PEM	Palustrine Emergent	High	6,427	1.59	4,187	1.04	4,189	1.03	4,189	1.03	4,187	1.04	4,187	1.04
30A	PEM	Palustrine Emergent	Low	904	0.22										
30C	PFO	Palustrine Forested	Medium	27,685	6.84										
31B	PEM/PFO	Palustrine Mixed	High											4,837	1.20
31E	PEM/PFO	Palustrine Mixed	Medium											2,592	0.64

Table III-52: Individual Wetlands Impacts of the Alternatives

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
33A	PFO	Palustrine Forested	High							3,507	0.87				
33C	PEM/PFO	Palustrine Mixed	High							780	0.19				
35A	PFO	Palustrine Forested	Medium							10,164	2.51				
35 Airport1	PFO	Palustrine Forested	Medium							2,341	0.58				
35 Goodwin2	PFO	Palustrine Forested	High					1,629	0.40						
37A	PEM	Palustrine Emergent	Medium	88	0.02	3,952	0.98					3,952	0.98	3,952	0.98
37C	PEM	Palustrine Emergent	Medium			1,438	0.36					1,438	0.36	1,438	0.36
37W	PEM	Palustrine Emergent	Low			154	0.04					154	0.04	154	0.04
38A	PFO	Palustrine Forested	Medium			4,360	1.08					4,358	1.08	4,358	1.08
38Z	PEM	Palustrine Emergent	Medium			466	0.12					466	0.12	466	0.12
39H	PFO	Palustrine Forested	High	301	0.07	298	0.07	301	0.07	301	0.07	298	0.07	298	0.07
4H	PFO	Palustrine Forested	High			2,414	0.60	2,404	0.59	2,404	0.59	2,414	0.60	2,414	0.60
4I	PEM/PFO	Palustrine Mixed	High			944	0.23	944	0.23	944	0.23	944	0.23	944	0.23
4J	PEM	Palustrine Emergent	Medium			1,274	0.32	1,275	0.32	1,275	0.32	1,274	0.32	1,274	0.32
4K	PFO	Palustrine Forested	High			991	0.25	990	0.25	991	0.25	991	0.25	991	0.25
53A	PFO	Palustrine Forested	High			2,846	0.70					2,817	0.70	2,703	0.67
53G	PEM	Palustrine Emergent	Low			52	0.01							7,010	1.73

Table III-52: Individual Wetlands Impacts of the Alternatives

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
6A	PFO/PEM	Palustrine Mixed	Medium	11,457	2.83										
7A	PFO/PEM/ PSS	Palustrine Mixed	Low	20,944	5.18										
7D	PEM/PFO	Palustrine Mixed	Medium	13,488	3.33										
7H	PEM	Palustrine Emergent	Low	308	0.08										
7I	PEM	Palustrine Emergent	Low	11,080	2.74										
7J	PEM/PSS	Palustrine Mixed	Medium	1,429	0.35										
7L	PEM	Palustrine Emergent	Low	136	0.03										
7R	PEM	Palustrine Emergent	Low	431	0.11	416	0.10					416	0.10	416	0.10
8A	PEM/PSS	Palustrine Mixed	Medium	1,922	0.48										
8B	PEM	Palustrine Emergent	Medium	3,698	0.91	50	0.01					50	0.01	50	0.01
8E	PEM	Palustrine Emergent	Medium	486	0.12										
9A1	PFO	Palustrine Forested	Medium	36,107	8.92										
9A2	PEM/PSS	Palustrine Mixed	High	12,020	2.97										
9A3	PFO	Palustrine Forested	Medium	6,274	1.55										
DPWX	PSS/PFO	Palustrine Mixed	Medium			2,551	0.63								

Yellow Alternative

The Yellow Alternative impacts 50.5 acres of ACOE jurisdictional wetlands and 20,708 linear feet of ACOE jurisdictional other waters of the US. These impacts are described in general in ***Table III-51*** and in detail in ***Table III-52***. The Yellow Alternative will also impact 0.4 acres of DNREC jurisdictional tidal wetlands, and 7,167 linear feet of subaqueous lands. These impacts are described in general in ***Table III-51***.

Purple Alternative

The Purple Alternative impacts 24.9 acres of ACOE jurisdictional wetlands and 16,257 linear feet of ACOE jurisdictional other waters of the US. These impacts are described in general in ***Table III-51*** and in detail in ***Table III-52***. The Purple Alternative will also impact 0.4 acres of DNREC jurisdictional tidal wetlands, and 6,461 linear feet of subaqueous lands. These impacts are described in general in ***Table III-51***.

Brown Alternative North Option

The Brown Alternative North Option impacts 23.9 acres of ACOE jurisdictional wetlands and 15,158 linear feet of ACOE jurisdictional other waters of the US. These impacts are described in ***Table III-51*** and in detail in ***Table III-52.*** The Brown Alternative North Option will also impact 0.4 acres of DNREC jurisdictional tidal wetlands, and 7,885 linear feet of subaqueous lands. These impacts are described in general in ***Table III-51.***

Brown Alternative South Option

The Brown Alternative South Option impacts 18.5 acres of ACOE jurisdictional wetlands and 14,278 linear feet of ACOE jurisdictional other waters of the US. These impacts are described in ***Table III-51*** and in detail in ***Table III-52***. The Brown Alternative South Option will also impact 0.4 acres of DNREC jurisdictional tidal wetlands, and 8,232 linear feet of subaqueous lands. These impacts are described in general in ***Table III-51.***

Green Alternative North Option

The Green Alternative North Option impacts 26.2 acres of ACOE jurisdictional wetlands and 15,515 linear feet of ACOE jurisdictional other waters of the US. These impacts are described in ***Table III-51*** and in detail in ***Table III-52.*** The Green Alternative North Option will also impact 0.4 acres of DNREC jurisdictional tidal wetlands, and 8,162 linear feet of subaqueous lands. These impacts are described in general in ***Table III-51.***

Green Alternative South Option

The Green Alternative South Option impacts 28.3 acres of ACOE jurisdictional wetlands and 16,326 linear feet of ACOE jurisdictional other waters of the US. These impacts are described in ***Table III-51*** and in detail in ***Table III-52.*** The Green Alternative South Option will also impact

0.4 acres of DNREC jurisdictional tidal wetlands, and 8,481 linear feet of subaqueous lands. These impacts are described in general in ***Table III-51.***

c. Mitigation

The large number of surface water and wetland features within the wetland investigation area makes complete avoidance of resources impractical for the build alternatives. However, a variety of alternatives have been generated in an effort to minimize and avoid impacts to these resources. Alignment changes and retaining walls will be evaluated where even the steepest slopes (2:1) will cause severe resource impacts. In addition, stormwater management ponds will be located to avoid wetland resources. In accordance with federal and state regulations, avoidance and minimization measures to reduce impacts to wetlands and waters would continue to be implemented for all phases of the project and will continue through final design.

Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts to wetlands as well as perennial and intermittent waters. Compensatory mitigation is being evaluated in accordance with state and federal regulations and guidance. Compensatory mitigation focuses on the replacement of the functions and values provided by an aquatic resource or wetland in addition to the acreage affected. Traditionally, mitigation requirements under Section 404 have been determined by the ratio of wetland acres replaced to wetland acres lost. Emergent wetlands are typically mitigated on a 1:1 replacement basis, while forested and scrub-shrub wetlands are mitigated on a 2:1 replacement basis.

The mitigation site selection process will focus on locating areas with the highest potential for wetland creation and stream restoration with emphasis on “in-kind” replacement within the watersheds potentially affected by the project. A formal mitigation site search will be conducted within the project area. The most important technical aspect of site selection will be to ensure that wetland hydrology is present or can be established at the proposed mitigation site. Since beaver activity is common along all the stream corridors in the project area, mitigation concepts will focus on site designs that will not attract beavers to the sites. High priority for mitigation selection will be given to adequately drained farmland areas where wetlands were historically present but have been replaced with agriculture. A high priority will also be given to areas containing hydric soils. In both instances, those areas that are publicly owned or are located within a publicly owned ROW will be especially favorable.

7. <u>Floodplains</u>

a. Existing Conditions

Floodplains have been identified using Federal Emergency Management Agency (FEMA) Q3 GIS data, a digital depiction of Flood Insurance Rate Map (FIRM) mapping. ***Figure III-19*** shows the FEMA 100-year floodplains in the project area. The project area is bisected by numerous low-gradient streams and their associated floodplains. Natural floodplains in New Castle County are typically forested and relatively wide, with extensive wetlands. The project area is roughly centered on the drainage divide between the Chesapeake Bay and Delaware Bay.

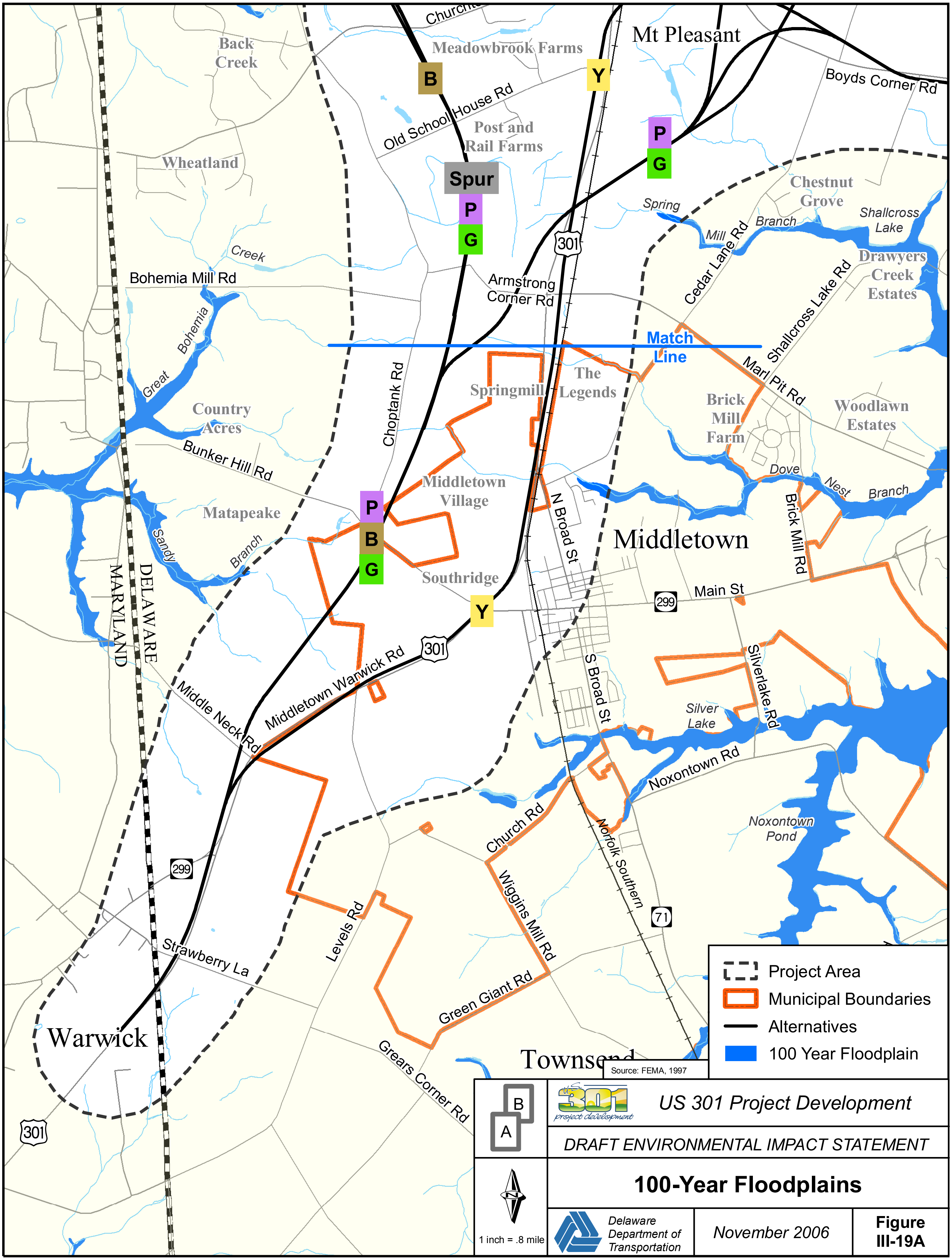
Streams west of the divide drain westward to the Chesapeake Bay; while streams east of the divide drain eastward to the tidal Delaware River. A few streams drain northward, directly into the C&D Canal. West of the divide, FEMA regulatory floodplains in the project area include Back Creek, Great Bohemia Creek, and Sandy Branch. East of the divide, FEMA regulatory floodplains in the project area include Scott Run, Augustine Creek, and Drawyer Creek (alternatively Drawer's Creek or Drawyer's Branch) and its tributaries, including Dove Nest Branch. In addition, a floodplain is delineated for the C&D Canal, accounting for the effects of storm surges originating in the Chesapeake Bay or Delaware River.

Federal, state, and local regulations govern fill and construction in floodplains. These regulations include Federal Executive Order 11988; US Department of Transportation Order 5650.2; the National Flood Insurance Act of 1968; and the New Castle County Unified Development Code, Section 40.

b. Environmental Consequences

The significance of floodplain encroachment was evaluated with respect to the criteria in Executive Order 11988 (Floodplain Management) and DOT Order 5650.2. Floodplain encroachments were also analyzed according to the Federal Aid Highway Program Manual, which recommends that longitudinal encroachment (encroachment that parallels the stream channel) be avoided whenever possible. Project alternates are not configured in such a manner that major longitudinal floodplain encroachments will occur. The majority of floodplain encroachments will be from transverse crossings for each of the alternatives (encroachment from roadway development that crosses the valley widths of floodplains). ***Table III-53*** presents the potential encroachment into FEMA-designated 100-year floodplains for each alternative. Floodplain impacts are estimated fill areas associated with the construction of the US 301 project. Final impacts to the 100-year floodplain will be determined based on hydrologic and hydraulic modeling, when the design of each structure is complete. Encroachments of non-delineated floodplains cannot be determined without such detailed studies; however, the number of such encroachments is assumed based on the number of streams crossed, as identified by blue lines on USGS maps within New Castle County, also shown in ***Table III-53***.

Project impacts to two tax ditch systems include direct crossings of the ditches, and contribution of runoff that ultimately drains to a tax ditch. One project stream crossing, common to all alignments, is located in Maryland, on an unnamed blue-line stream without a FEMA floodplain. At this location, an existing culvert may be extended or upgraded to accommodate highway widening and lane transitions. No new stream crossing is proposed within Maryland. Individual alignments are discussed below.



US 301 Project Development

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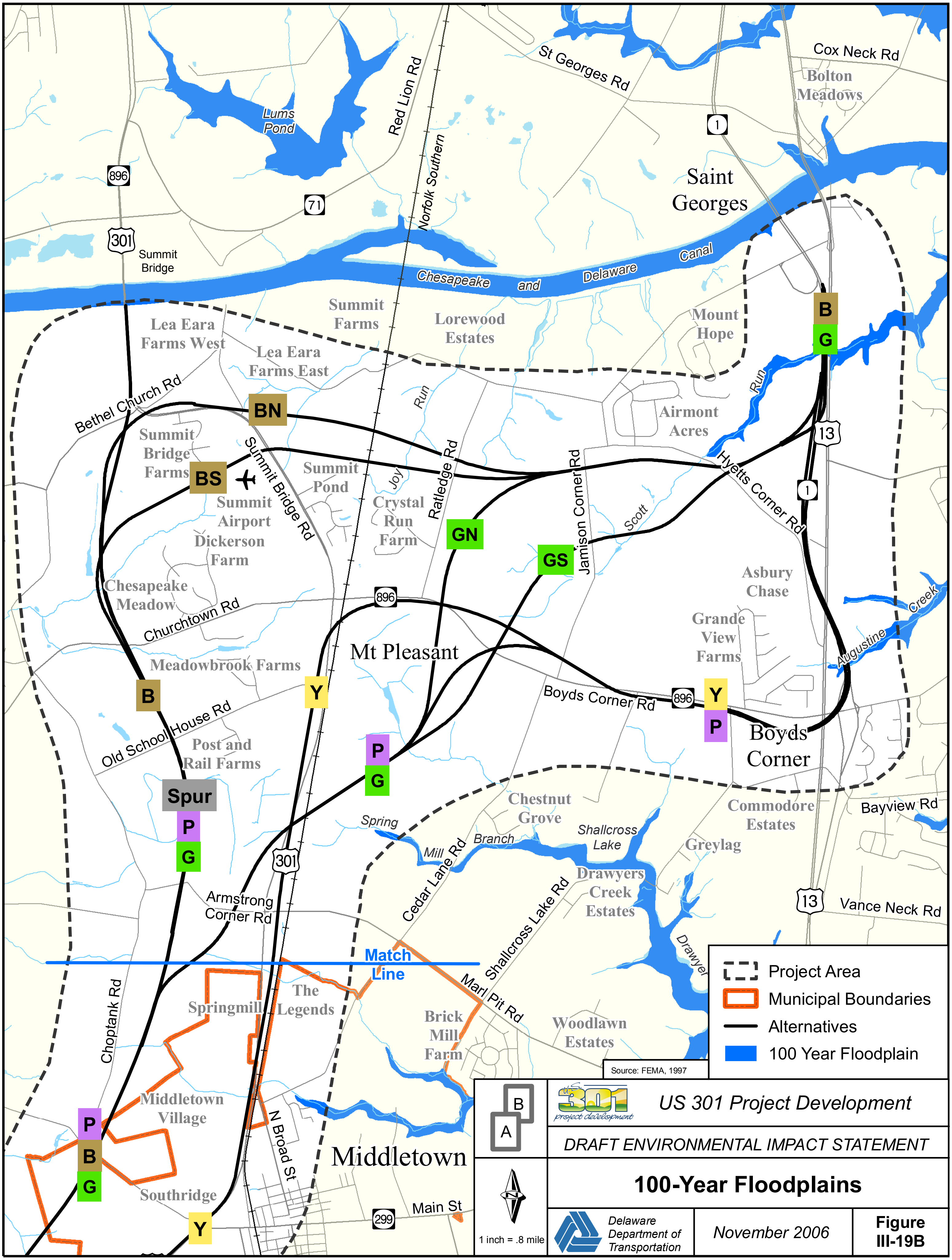
100-Year Floodplains

Delaware Department of Transportation

November 2006

Figure III-19A



US 301 project development

US 301 Project Development

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100-Year Floodplains

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Figure III-19B

Table III-53: Floodplain and Tax Ditch Impacts

Alternative	Yellow	Purple	Brown North	Brown South	Green North	Green South
Floodplain Impact						
Area of FEMA (Q3) Floodplain (acres)	1.5	1.5	1.0	1.0	1.0	1.0
Non-Delineated Floodplain (Number of Crossings)	5	12	11	10	11	14
Tax Ditch Impact						
Tax Ditches Crossed or Relocated (linear feet)	81	624	0	192	624	654
Tax Ditch Watershed Area (acres)	12	67	28	56	67	67

The No Build Alternative has no impacts to floodplains or tax ditches.

The Yellow Alternative crosses the Augustine Creek FEMA floodplain, 5 non-delineated floodplains, and the Drawyers Branch tax ditch system.

The Purple Alternative crosses the Scott Run FEMA floodplain, 12 non-delineated floodplains, and the Drawyers Branch tax ditch system.

The Brown Alternative North and South Options cross the Scott Run FEMA floodplain. The Brown North Option crosses 11 non-delineated floodplains and contributes runoff to the Drawyers Branch and Deats tax ditches. The Brown South Option crosses 10 non-delineated floodplains, crosses the Deats tax ditch system, and contributes runoff to the Drawyers Branch tax ditch.

The Green Alternative North and South Options cross the Scott Run FEMA floodplain. The North Option crosses 11 non-delineated floodplains and the Drawyers Branch tax ditch; the South Option crosses 14 non-delineated floodplains and the Drawyers Branch tax ditch.

FEMA floodplain impacts for the build alternatives range from 1.0 acres for the Brown and Green Alternatives to 1.5 acres for the Yellow and Purple Alternatives. Non-delineated floodplain impacts range from 5 crossings for the Yellow Alternative to 14 crossings for the Green South Alternative. Tax ditch impacts range from zero for the Brown North Alternative to 654 linear feet for the Green South Alternatives. Finally, tax ditch watershed impacts range from 12 acres for the Yellow Alternative, to 67 acres for the Purple and Green Alternatives.

Efforts to avoid and minimize impacts to 100-year floodplains are ongoing, and will continue throughout the planning and engineering process. Longitudinal crossings have been avoided because they would result in more floodplain fill, reducing conveyance and floodplain storage. Where permitted by the surrounding topography and environment, proposed bridge lengths are well in excess of the minimum hydraulic opening required to pass the design flood flows, thus preserving sensitive wetlands and floodplains. The studied alignments also minimize floodplain impacts by their location near the Chesapeake-Delaware drainage divide, where stream and floodplain crossings tend to be narrower than further downstream. Techniques to further minimize or avoid impacts may include additional bridging of floodplains to further reduce encroachment and allow for unrestricted passage of floodwaters, and minimization of embankment footprint via retaining walls and soil stabilization. Through compliance with local design requirements to convey the 100-year flood discharge unimpeded, offsite floodplain impacts will be minimized. Hydrologic and hydraulic studies will be conducted to determine the bridge or culvert opening sizes for the various alternatives.

c. Mitigation

All construction occurring within the FEMA-designated 100-year floodplain and New Castle County non-delineated floodplains will comply with FEMA-approved local floodplain construction requirements, including the prohibition on fill in the floodway and passage of the 100-year flood without increasing water surface elevations. Any increases would require easement purchase. If required by New Castle County, compensatory storage may be excavated from floodplains to mitigate the effects of embankment fill. Affected tax ditches will be relocated along the toe of the highway embankment, or passed beneath the proposed highway in culverts, in order to maintain present ditch flow patterns.

8. Vegetation and Wildlife

a. Terrestrial Habitat and Wildlife

Existing Conditions

Terrestrial habitat types were classified according to aerial mapping as well as field observations. Forested areas were characterized during field investigations. Forest data were then analyzed and classified according to associations described in the Society of American Foresters *Forest Cover Types of the United States and Canada* (Eyre (ed.), 1980). Several different habitat types occur throughout the project area. An overview of each habitat type, as well as the general type of wildlife each supports, is included below.

Developed Habitat

Developed habitat includes commercial, residential, industrial and park areas. This comprises the majority of the habitat found within the project area along existing US 301. Wildlife found in developed habitat includes species adapted to “edge habitats” created when developed habitat is adjacent to agriculture or forest. These species include: white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), mice (*Mus sp*.), as well as birds such as European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), and eastern bluebird (*Sialia sialis*).

Vegetation in developed habitat includes both native and invasive exotic plants. Common native trees include yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), sweetgum (*Liquidambar styraciflua*), Willow oak (*Quercus phellos*), Pin oak (*Quercus palustris*), Loblolly pine (*Pinus taeda*), black willow (*Salix nigra*), black locust (*Robinia pseudoacacia*), and smooth alder (*Alnus serrulata*). Common native shrubs include silky dogwood (*Cornus ammonum*), witch hazel (*Hamamelis virginiana*), inkberry (*Ilex glabra*), winterberry (*Ilex verticillata*), Virginia sweetspire (*Itea virginica*), spicebush (*Lindera benzoin*), wax myrtle (*Myrica cerifera*), northern bayberry (*Myrica pensylvanica*), black chokeberry (*Photinia melanocarpa*), beach plum (*Prunus maritima*), staghorn sumac (*Rhus hirta*), common elderberry (*Sambucus canadensis*), steeplebush (*Spiraea tomentosa*), and arrowwood (*Viburnum dentatum).* Common native herbaceous plants include Christmas fern (*Polystichum acrostichoides*), sweet fern (*Comptonia peregrina*), panic grass (*Dichanthelium commutatum*), Virginia wild rye (*Elymus virginicus*), switchgrass (*Panicum virgatum*), little bluestem (*Andropogon scoparius*), common milkweed (*Asclepias syriaca*), nodding beggar-ticks (*Bidens cernua*), golden aster (*Chrysopsis mariana*), gayfeather (*Liatris spicata*), phlox (*Phlox maculata*), and black-eyed Susan (*Rudbeckia hirta*).

Common invasive exotic trees include Bradford pear (*Pyrus calleryana Bradford*), Norway maple (*Acer platanoides*), princess tree (*Paulownia tomentosa*), tree of heaven (*Ailanthus altissima*), and silk tree (*Albizia julibrissin*). Common invasive shrubs and vines include honeysuckle shrub and vine (*Lonicera spp.*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), porcelain berry (*Ampelopsis brevipedunculata*), wisteria vines (*Wisteria spp*.), creeping euonymus (*Euonymus fortunei*), bittersweet (*Celastrus orbiculatus*), English ivy (*Hedera helix*), and winged burningbush (*Euonymus alata*). Common invasive exotic herbaceous plants include garlic mustard (*Alliaria petiolata*), Japanese stiltgrass (*Microstegium vimineum*), lesser celandine (*Rununculus ficaria*), purple loosestrife (*Lythrum salicaria*), Canada thistle (*Cirsium arvense*), common daylily (*Hemerocallis fulva*), common reed (*Phragmites australis*), kudzu (*Pueraria montana*), and kile-a-minute (*Polygonum perfoliatum*).

Agricultural Land

Agricultural land comprises the majority of habitat found within the project area. Agricultural land is comprised of crop fields, hayfields, and pasture land. Large areas of agricultural land are found south of the C&D Canal and are often separated by narrow tree rows, roadways, stream valleys, residential or commercial areas. Wildlife which typically dwell or feed in agricultural land includes white-tailed deer, red fox, raccoon, various rodent species, and upland game birds.

Meadow Habitat

Meadow habitat is mostly comprised of former agricultural land abandoned for several years. These areas are classified as early successional upland habitat or herbaceous upland habitat. Vegetation in these areas consists of pioneering grasses and forbs, including panic grass, Virginia wild rye, switchgrass, little bluestem, common milkweed, nodding beggar-ticks, golden aster, gayfeather, phlox, and black-eyed Susan. Wildlife species found in meadow habitat include woodchuck (*Marmota monax*), kildeer (*Charadrius vociferous*), and in areas where the rodent population is abundant, various birds of prey such as red-tailed hawk (*Buteo jamaicencis*) and American kestrel (*Falco sparverius*). Reptiles such as the eastern garter snake (*Thamnophis sirtalis*) may also inhabit meadows.

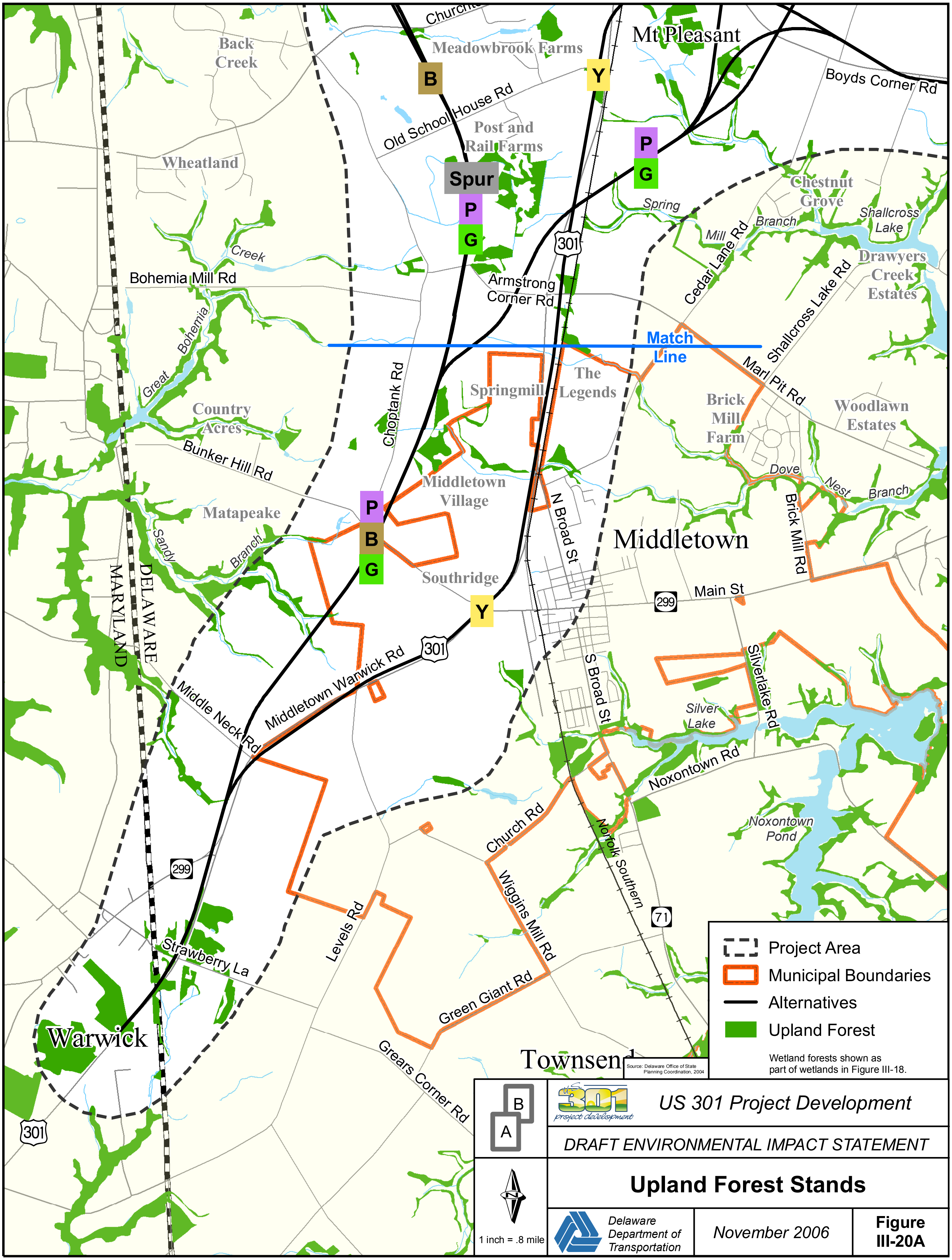
Forest Habitat

Forest habitat occurs sporadically throughout the project area and consists mainly of small fragmented forest stands or narrow tree rows between agricultural fields. Linear forests occur in the stream valleys of several streams, including Scott Run, Joy Run, Crystal Run, Back Creek, Sandy Branch, Dove Nest Branch, and Drawyer Creek. Large tracts of forest are located southeast of the intersection of US 301 and Boyds Corner Road, west of US 301 north of the town of Middletown. Forests within the project area are generally characterized as early- to mid-successional. Forests were characterized during field investigations and were classified by associations based on the Society of American Foresters *Forest Cover Types of the United States and Canada* (Eyre, 1980). ***Table III-54*** lists the number of stands identified in each association. Forest cover in the project area is shown on ***Figure III-20***.

The dominant association found throughout the project area is the Red Maple Association. Other associations in order of occurrence include: Yellow Poplar, White Oak, Sweetgum-Willow Oak, Pin Oak-Sweetgum, Loblolly Pine, Black Willow, and Black Locust. Stands which could not be classified as a single association are described as “Mixed.” The Society of American Foresters *Forest Cover Types* description for each association is listed below.

Table III-54: Forest Stands by Association

Association	Number of Forest Stands Identified in Project Area
Red Maple	41
Yellow Poplar	9
White Oak	7
Sweetgum-Willow Oak	4
Pin Oak-Sweetgum	3
Loblolly Pine	1
Black Willow	1
Black Locust	1
Mixed	7
Total Number of Stands Identified	**74**



US 301 Project Development

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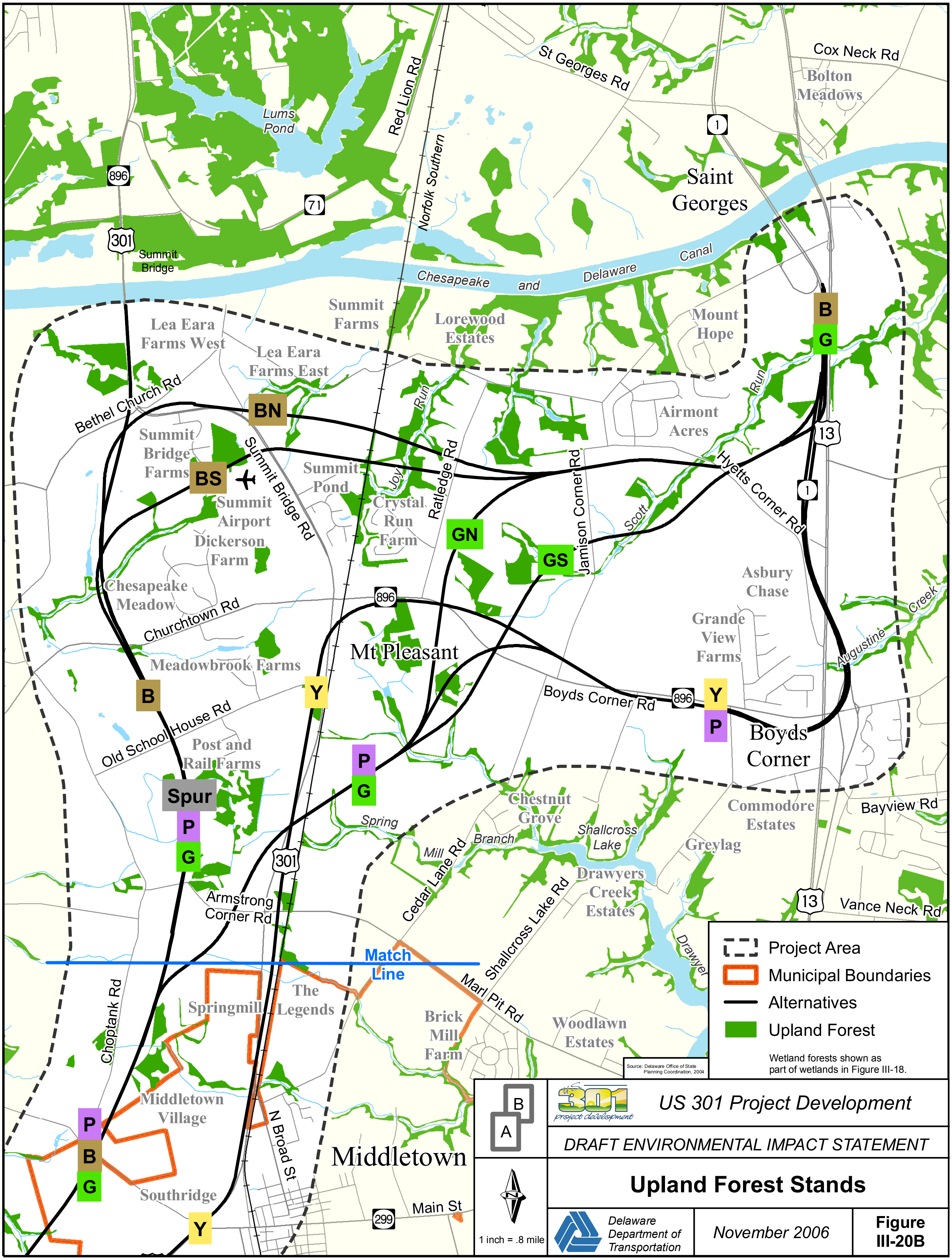
Upland Forest Stands

Delaware Department of Transportation

November 2006

Figure III-20A



US 301 Project Development

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Upland Forest Stands

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Figure III-20B

The Red Maple Association, while dominated by red maple (*Acer rubrum*), is associated with other tree species including white pine (*Pinus strobus*), black cherry (*Prunus serotina*), northern red oak (*Quercus rubra*) and sweetgum. This association can be found on sites ranging from extremely wet to dry because of the adaptable nature of the red maple tree. Soils range from poorly drained bottomland soils to well drained upland soils. Since the red maple is a relatively short-lived tree, this association is generally considered an early- to mid-successional forest type (Powell & Erdmann; in Eyre, 1980). This association occupies an extensive numbers of forests throughout the project area.

The Yellow Poplar Association is dominated by the yellow poplar and often occurs in large, uninterrupted stands. Other trees species associated with yellow poplar include American beech (*Fagus grandifolia*), northern red oak, blackgum (*Nyssa sylvatica*) and hickories (*Carya ovata*). Soils in this association are derived primarily from sandstones or shales and tend to be moderately deep to deep, moist, well-drained, and medium to fine in texture. This association is more responsive to site quality than other northeastern hardwoods and is typically found on higher quality sites (Tryon; in Eyre, 1980). The Yellow Poplar Association is found in several areas along Joy Run and an unnamed tributary to the C&D Canal east of Joy Run, as well as along Spring Mill Branch north of Marl Pit Road.

The White Oak Association often occurs in pure stands. Other trees associated with white oak include northern red oak, scarlet oak (*Quercus coccinea*), blackgum, yellow poplar, and white pine. This association is found on a wide variety of sites ranging from dry to moderately wet, and is sometimes found on poorly drained bottomland soils with high clay content (Sander; in Eyre, 1980). The White Oak Association is found along Spring Mill Branch north of Marl Pit Road and in several areas east of SR 15 north of the town of Middletown.

The Sweetgum-Willow Oak Association is characterized by sweetgum and willow oak being the key species. Green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*) are also associated with this association. This association is common on relatively poorly drained bottom ridges, terrace flats, and transitional sites (Johnson; in Eyre, 1980). The Sweetgum-Willow Oak Association is found east and west of existing US 301, north of Marl Pit Road.

The Pin Oak-Sweetgum Association, while dominated by pin oak and sweetgum, is associated with other trees including red maple, American elm and willow oak. This association is typically an early-successional forest type in the regrowth of bottomland forests and is found in broad stream valleys and poorly-drained depressional areas (Weaver; in Eyre, 1980). The Pin Oak-Sweetgum Association is found along existing US 301 north of the town of Middletown and along Scott Run near Jamison Corner Road.

The Loblolly Pine Association is typically characterized by pure stands of loblolly pine or forests stands where loblolly pine dominates. Sweetgum is associated with this association. This association occurs on soils ranging from somewhat poorly drained to well-drained uplands (Crow; in Eyre, 1980). The Loblolly Pine Association is found near US 301 at the Delaware/Maryland state line as a narrow hedgerow feature.

The Black Willow Association, dominated by black willow and other species of willow, is a rapid growing pioneer tree species. Trees associated with this association include green ash, sycamore (*Platanus occidentalis*) and red maple. In the Eastern US, it is most commonly found in swamps, along newly formed sandbars and along river margins (Krinard; in Eyre, 1980). The Black Willow Association is found along Scott Run near Hyetts Corner Road.

The Black Locust Association, dominated by the black locust, is a pioneer forest type. It is typically found in disturbed areas along roadways and in medians (Roach; in Eyre, 1980). The Black Locust Association is found along existing US 301 just south of the C & D Canal.

Mixed forested areas cannot be classified as a specific association since they are generally comprised of combinations of the species listed above. Mixed associations are found throughout the project area.

<u>Environmental Consequences</u>

Impacts to non-forested habitat as a result of this project will result from the addition of paved road surfaces. Impacts to wildlife will be indirect through habitat loss or modification. Other habitat impacts could include the introduction of exotic and invasive species to areas of increased human disturbance. The greatest numbers of impacts to non-forested habitat and wildlife will occur as part of the off-alignment alternatives, namely the Purple, Brown, and Green Alternatives, since these alternatives will have the highest amounts of habitat reduction and/or fragmentation. Impacts to non-forested habitat resulting from the Yellow Alternative are expected to be less because most construction will occur adjacent to existing US 301.

Forest impacts in Delaware are regulated by the Delaware Forest Conservation Act (Delaware State Senate Bill #324). Mitigation requirements as outlined by the Delaware Forest Conservation Act are:

- 1-10 trees removed = 1:1 tree replacement ratio;
- 11-49 trees removed = 2:1 tree replacement ratio;
- 50 or more trees removed = acre for acre forest area replacement ratio.

Mitigation for impacts to forest areas will be determined during the design phase of the project following detailed delineation of forest stands. Impacts to forest areas have been divided among upland and wetland forests. Wetland forest data are described in **Section F.6** of this chapter and are not included as part of the forest impact data provided in this section. Impacts to forested habitat will vary according to each alternative and are shown in ***Table III-55***.

Table III-55: Potential Forest Impacts (in acres)

Forest Type	No-Build	Yellow	Purple	Brown North	Brown South	Green North	Green South
Deciduous Forest	0	21.4	39.2	35.8	46.6	33.4	36.1
Evergreen Forest	0	9.2	0	1.0	3.7	0	0
Mixed Forest	0	6.3	0.7	0.7	0.7	0.7	0.7
Total	**0**	**36.9**	**39.9**	**37.5**	**51**	**34.0**	**36.8**

Three of the largest uninterrupted tracts of upland forest in the project area, at Mount Pleasant (150+ acres), south of Post and Rail Farms (80+ acres) and just north of Middletown Village (100+ acres) are not directly impacted by any alternative. No impacts to forested habitat will occur as part of the No-Build Alternative.

The Yellow Alternative would impact 36.9 acres of forested habitat. Since much of the Yellow Alternative will be constructed along the existing US 301 alignment, impacts to forest habitat are expected to be minimal in the area along the existing US 301 alignment because much of the area is already non-forested. However, where the Yellow Alternative turns east-west along SR 896, a large forest stand located southeast of the intersection of US 301 and SR 896 will be impacted.

The Purple Alternative would impact 39.9 acres of upland forested habitat. Although much of the area along the Purple Alternative alignment is non-forested, a few large forested areas will be impacted. Stands that will be impacted are located adjacent to Sandy Branch and Drawyer Creek and west of existing US 301, north of the town of Middletown.

The Brown Alternative North Option would impact 37.5 acres of upland forested habitat; the Brown Alternative South Option would impact 51 acres. Forest impacts resulting from the Brown Alternative, west of existing US 301, are anticipated to be similar to that of the Purple Alternative. Where the Brown Alternative parallels existing US 301, north of Churchtown Rd., several forested areas adjacent to Back Creek will be impacted. Minimal impacts are anticipated where the Brown Alternative turns east-west, south of Lorewood Grove Road.

The Green Alternative North Option would impact 34 acres of upland forest habitat; the South Option would impact 36.8 acres. Impacts resulting from the Green Alternatives can be anticipated to be similar to those of the Purple and Brown Alternatives. The North Option would impact several forest stands adjacent to Scott Run.

Direct and indirect impacts of the alternatives on fauna include habitat loss and alteration, changes in animal populations and communities, and mortality from wildlife-vehicular collisions. The No-Build Alternative would have no impact on fauna. The greatest impact to fauna resulting from the build alternatives would be habitat loss. Alteration of existing habitat rendering fauna unsuited to their original faunal assemblages is also considered loss of habitat. Construction activities will result in actual acreage losses of habitats and habitat alterations.

Habitat fragmentation or compartmentalization, especially in relation to large woodland tracts, is a consequence of transportation corridor projects since new roadways cross habitat and form barriers for wildlife travel. Since much of the landscape in the project area is a mosaic of open fields, hedgerows, scattered forests commonly connected to wetlands, and scattered residential areas, fragmentation resulting from any of the alternatives would be minor. Most of the wetland crossings will be bridged with the build alternatives which will help maintain corridor passage for fauna. There are a few instances where wetlands will be filled and wildlife corridors will be interrupted. Here the roadway, acting as a barrier, will likely result in increased roadkills, especially for smaller animals. The severity of such impacts cannot be quantified without extensive study of existing and post-construction animal movement patterns. Increased barrier width of roadways and habitat fragmentation would cause larger animals, such as deer, to travel parallel to the roadways until bridges or crossing points are found. This may be particularly problematic at the few roadways where forested wetlands are filled and a bridge is not provided. However, cutting off or blocking of travel access for terrestrial wildlife would not impact common regional wildlife populations because, despite the increased difficulty, many animals would still cross successfully and many suitable crossing areas would remain.

b. Aquatic Biota

Aquatic biota within the project area have been historically affected through population growth, industrial and urban development, and harvesting of natural resources beginning in the 19th century. In recent years, a resurgence of beaver have modified forested wetland corridors and affected aquatic biota because of flooding, directly destroying trees, and threatening infrastructure. Beaver populations were noted throughout the project area. Aquatic biota commonly observed in the project area include fish, reptiles, mammals, birds and amphibians that live in and around these freshwater systems.

<u>Existing Conditions</u>

Fish

Common types of fish found in New Castle County, Delaware consist of warm-water species typically observed in the Coastal Plain Province of the Mid-Atlantic United States. Fish populations consist of both native and non-native species. Common freshwater species identified in the Delaware include American eel (*Anguilla rostrata*), brown bullhead (*Ictalurus nebulosus*), pumpkinseed (*Lepomis gibbous*), bluegill sunfish (*Lepomis macrochirus*), black-nosed dace (*Rhinichthys atratulus*), white sucker (*Catostomus commersoni*), white perch (*Morone Americana*), largemouth bass (*Micropterus salmoides*), and tessellated darter_(*Etheostoma olmstedi*). Common non-native species found in the project area surface waters include the common carp (*Cyprinus carpio*) and the grass carp (*Ctenopharyngodon idella*).

Data inventories of fish and other aquatic life and aquatic habitats within project area surface water features were limited. Fish species most commonly observed during field investigations included minnow species (*Cyprinidae sp.*) and largemouth bass in the larger perennial streams.

Dominant populations of minnows and sunfishes species were also observed in smaller, low-gradient streams and eutrophic ponds where floating emergent vegetation was prominent.

No federally listed endangered fish species are found in the project area. The shortnose sturgeon (*Acipenser brevirostrum*) is the only federally listed endangered species in the state and is found only occasionally in Delaware tidal waters.

No state listed endangered fish species were found in the project area. The blackbanded sunfish (*Enneacanthus chaetodon)* is the only state listed endangered species that may potentially be found within the project area.

No Essential Fish Habitat is found in the project area. Essential Fish Habitat has been identified in Delaware Bay and in the Delaware Inland Bays, both of which lie outside the project area.

Benthic Macroinvertebrates

DNREC's Division of Water Resources monitors the health of non-tidal streams throughout the state through an ecological assessment of the benthic macroinvertebrate community and physical habitat evaluation. Habitat evaluation is determined by assigning a rating to stream conditions such as habitat depletion, stream alteration, bank erosion, and the presence/lack of vegetation. The condition of biological communities is assessed according to such factors as habitat, pollution impact, and the occurrence of extreme hydrologic events. DNREC uses the results of these monitoring events to gauge future stream and habitat restoration projects and to assess future water quality monitoring efforts.

Through DNREC assessment, scores from 0-20 are assigned for each habitat parameter to derive a Habitat Comparison Index (HCI). Sites are then classified on a range from severely degraded to excellent based on their HCI score. Benthic macroinvertebrates are collected to complete a biological assessment of the stream community. A total of five measurement parameters are compared to regional reference values to determine a Biotic Comparison Index (BCI). Sites are then classified from severely degraded to excellent based on their BCI score.

As part of their statewide ecological assessment, DNREC's Division of Water Resources has conducted macroinvertebrate sampling of a number of streams located within the project area including: Dove Nest Branch, Spring Mill Branch, Crystal Run, Joy Run, Scott Run, Great Bohemia Creek and tributaries of Back Creek and Sassafras River. Sandy Branch, a tributary to the Great Bohemia Creek in the Chesapeake watershed was not sampled. Macroinvertebrate data, collected by DNREC, shows that benthic populations consist of a diverse range of sensitive to tolerant species in these streams. Dove Nest Branch was listed as moderately degraded, and one station on the Sassafras River was listed in good condition. An additional station on the Sassafras River, along with Spring Mill Branch, Crystal Run, Joy Run, Scott Run, Back Creek, and Great Bohemia Creek were listed as severely degraded.

Habitat assessments conducted by DNREC showed that streams located in the project area were classified from good condition to severely degraded. Spring Mill Branch and one station on the Sassafras River were classified as severely degraded. A different station on the Sassafras River was classified in good condition. Dove Nest Brach, Crystal Run, Joy Run, Scott Run, Back Creek and Great Bohemia Creek were classified as moderately degraded. The moderate to severely degraded status of many of these streams indicates ongoing anthropogenic impacts including habitat loss, pollution and increased development and urbanization.

Aquatic Plants

A variety of aquatic vegetation can be found throughout the freshwater streams, lakes and ponds located in the project area. Wetland vegetation is consistent with that found in freshwater marshes, swamps and bogs of wetlands in the Coastal Plain of the Mid-Atlantic United States.

The invasion of natural plant habitats from non-native plants is the most common problem facing Delaware's native aquatic plant species. Exotic vegetation, often fueled by nutrient enrichment, out-competes beneficial native vegetation and can clog waterways, diminish fishing, and degrade water quality. The most harmful exotic aquatic invaders include filamentous algae and two species of submerged aquatic vegetation (SAV): hydrilla (*Hydrilla verticillata*) and cabomba or Carolina fanwort (*Cabomba caroliniana*). Control methods including the use of aquatic herbicides and mechanical harvesting, have been shown to be the best way to mitigate the impacts of these exotic aquatic plants.

<u>Environmental Consequences</u>

Impacts to aquatic biota may result from each of the build alternatives. Only the No-Build Alternative would result in no impacts to aquatic biota. Direct impacts that result from bridge or roadway construction, land development or other related activities may cause the direct loss of aquatic plants and animals located within the project area. The extent of impacts from construction activities related to this project will depend on the type of construction activity and individual tolerance and pollutant sensitivity of fish, macroinvertebrates and other aquatic life.

Additional impacts that may occur as a result of this project include increased stormwater runoff and pollution resulting from an increase in impervious surfaces along with car and truck traffic. This can affect overall water quality for project area surface waters, in turn affecting the food sources of fish and other aquatic life. A population decrease of one species integral to the food chain can affect other species along with the success of the aquatic community.

<u>Mitigation</u>

Minimizing impacts to aquatic biota can help ensure that native plant and animal species found in the project area can be maintained. Design modifications will be investigated in sensitive areas and appropriate mitigation would be implemented when impacts cannot be avoided. BMPs would be implemented before, during and after construction to reduce impacts to aquatic biota. Proper steps may be taken to eliminate or reduce non-native species. A program to remove non-native plants and reestablish native populations would be implemented to mitigate those areas where native species have been removed due to construction activities.

9. Rare, Threatened and Endangered Species

The following section identifies the federal and state listed rare, threatened and endangered (RTE) species potentially occurring within the project area and potential impacts to RTE species resulting from the project alternatives. Rare, threatened or endangered species and unique or critical habitat is regulated at the federal level through Section 7 of the Endangered Species Act (1973; 50CFR17) and at the state level through Title 7 of the Delaware Code (7 Del.C. §§ 601 – 605).

a. Existing Conditions

Information on rare, threatened or endangered species and critical habitat within the project area was obtained through agency coordination. Response letters were received from US Fish and Wildlife Service (USFWS), Delaware Department of Natural Resources and Environmental Control (DNREC), DNREC Natural Heritage and Endangered Species Program (DNHP), Maryland Department of Natural Resources (DNR), and DNR Environmental Review Unit (ERU). Information on rare, threatened, or endangered species within the project area was also acquired through field observations.

Letters requesting information on rare, threatened or endangered species, and critical habitat were sent on May 13, 2005 to USFWS and DNHP. Agency correspondence is attached in **Appendix E**.

USFWS indicated, in a response dated August 17, 2005, that the federally threatened bog turtle (*Clemmys muhlenbergii*) may be present within the project area. According to the USFWS response, bog turtles "…primarily inhabit palustrine wetlands comprised of a muddy bottom or shallow water, and tussocks of vegetation." The response suggested that a survey evaluating bog turtles and their habitat may be appropriate. USFWS also noted the presence of a federally threatened bald eagle (*Haliaeetus leucophalus*) nest within the vicinity of the project area, located along Scott Run approximately 1 mile east of US 301.

DNHP indicated in a letter dated July 25, 2005 that several rare, threatened or endangered species are known to occur within or adjacent to the project area. DNHP indicated that the project area contains State Wildlife Area Lands which are managed by DNREC's Division of Fish and Wildlife. DNHP recommended consultation with the State's Regional Wildlife Biologist to minimize impacts to State Wildlife Area Lands. DNHP suggested further agency coordination as the project moves forward.

Letters requesting information on rare, threatened or endangered species were sent to the Maryland DNR Environmental Review Unit and Wildlife & Heritage Division on October 20,

2005. DNR indicated in a letter dated December 7, 2005 that there were no records of state or federal species within the portion of the project located in Maryland.

There has been ongoing consultation with both USFWS and DNREC as part of several Agency Review Meetings (April 14, May 23, July 12, August 23 and November 8, 2005) and field views (August 8, August 12, September 8 and September 22, 2005). Rare, threatened, and endangered species coordination for this project will continue throughout the project development process. Additional information was requested and received from DNREC concerning the potential presence of a bald eagle nesting site along Scott Run near SR 1 and/or the presence of bald eagles at the headwaters of Shallcross Lake adjacent to existing US 301.

Bald Eagles and Other State-Listed Species

Bald eagles were not observed during field investigations. The active nest locations identified by DNHP are located outside the project area.

Most of the species identified by DNREC as having been observed in the project area (four-toed salamander, great purple hairstreak, Mitchell's sedge, alewife floater, marsh marigold, hairy woodrush, abruptly bent backed flatsedge) were also not observed within the project area during field investigations. While a few field investigations on select wetlands were conducted with DNREC to identify state rare species or likely habitat, it should be noted that most field investigations were not conducted specifically to identify rare species and most of the field investigators were not trained to identify rare species. However, the state listed queen snake was identified during Phase II and Phase III bog turtle surveys on Scott Run, Back Creek, Crystal Run, and Joy Run. In addition, cattail sedge (*Carex typhina*), a state rare plant not identified in correspondence with DNREC, was identified in the project area near Mount Pleasant.

Bog Turtles

To comply with the recommendations of DNHP regarding bog turtles, a Phase I Bog Turtle Survey was completed in the Fall 2005 and Winter 2006. USFWS Bog Turtle Habitat Evaluation Forms were completed for each delineated wetland in the project area. The survey evaluates those areas identified as potential bog turtle habitat during wetland field investigations. The project area for the Phase I assessment includes areas up to one-half mile from the proposed Yellow, Purple, Brown and Green alignments. Assessment protocols were field reviewed with DNHP on August 8, 2005. Phase I results were reviewed with DNHP during a meeting conducted on December 8, 2005.

The Phase I Survey completed forms and final report are included in *Investigation for Wetlands and Waters of the United States and Phase I Bog Turtle Habitat Assessment* (DelDOT, 2006). The survey was conducted according to methods outlined by DNHP in *Bog Turtle Survey Procedures - Delaware* (Revised January 2005) and by USFWS in *Guidelines for Bog Turtle Surveys* (Revised April 2006). Potential habitat was assessed by a state-approved bog turtle surveyor. Twenty-seven areas in approximately ten wetland systems were identified by DelDOT as potential bog turtle habitat. Most of these areas were reviewed in the field with DNHP on February 23, 2006 to ascertain that all potential habitat had been identified. Potential bog turtle habitat was identified in the following areas:

- In the eastern section of the project study area along Scott Run near SR 1,
- Along Crystal Run, Joy Run and another tributary of the C&D Canal east of Joy Run (north and south of Lorewood Grove Road),
- Along Back Creek and its tributaries near Choptank Road in the northwestern section of the project study area,
- Several areas adjacent to existing US 301 (north of the town of Middletown and south of Boyds Corner Road),
- Along Sandy Branch and its tributaries.

Based on these findings, a Phase II Bog Turtle Survey was completed by state-approved bog turtle surveyors for the 27 areas of potential habitat. The Phase II survey was conducted between April 15 and June 15, in compliance with the requirements specified by USFWS and DNREC. At select areas of potential habitat, Phase III (trapping) surveys were conducted by DNREC and USFWS-approved surveyors.

No bog turtles were discovered during any of the Phase II or Phase III surveys. Details of the Phase II/III survey locations, methods, and results are included in *Phase II/III Bog Turtle Surveys for US 301 Corridor Improvement Project* (DelDOT, August 2006).

b. Environmental Consequences

Bog Turtles

No bog turtles were discovered within any areas of potential habitat identified within one-half mile of the proposed alternatives. However, bog turtles were identified in 1972 at one location within one of the watersheds potentially affected by the alternatives. The historical record location and the specific watershed will not be identified in this document in compliance with the Endangered Species Act. Bog turtles are directly threatened by poaching activities and disclosing the location of the historical population may constitute a threat to that population. Based on the historic occupation and the bog turtle life span, the entire watershed is evaluated as a “potentially occupied” bog turtle area. Impacts to the watershed resulting from the build alternatives are evaluated below. A detailed assessment of potential impacts will be documented in a Biological Assessment prepared for the Preferred Alternative prior to the completion of the Final Environmental Impact Statement.

The No-Build Alternative will not impact the potentially occupied watershed and have no impacts to bog turtles or bog turtle habitat.

The Yellow, Purple, Brown and Green Alternatives will impact the potentially occupied watershed which could result in direct bog turtle impacts and in indirect and direct bog turtle habitat impacts. Based on the 1972 historical record, and the results of the 2006 Phase II/III survey, bog turtles may or may not be present in the potentially occupied area. If they are present, population levels are likely low. Therefore, the potential for impacts to the bog turtle may be minimal. Potential direct bog turtle impacts could include road mortality and construction related mortality. Direct bog turtle habitat impacts include filling of wetlands. Indirect bog turtle habitat impacts include wetland hydrology alteration and introduction of invasive plant species. Each type of potential impact to bog turtles and bog turtle habitat is described below.

Road Mortality

The Yellow, Purple, Brown, and Green Alternatives have the potential to cause turtle road mortality because each alternative crosses the potentially occupied watershed where turtles could, if they exist, climb up onto the road. The Yellow and Purple alternatives have the fewest crossings and the lowest potential for road mortality. Green South has most crossings and the highest potential for road mortality. Brown North, Brown South and Green North each have an intermediate number of crossings and moderate potential for road mortality. Road mortality should be limited since all the crossings will consist of elevated bridges over the wetlands. These crossings could be designed to allow unrestricted turtle movement under the road and maintain travel corridors for any future turtle movements.

Other measures such as fencing or solid barriers could be placed along the new roadway to ensure that turtles cannot cross the road.

Mortality During Construction

The Yellow, Purple, Brown, and Green Alternatives have the potential for construction-related mortality when work is being conducted within wetlands in the potentially occupied watershed. The Yellow and Purple alternatives have the smallest limit of disturbance and the lowest potential for construction mortality. Green South has the largest limit of disturbance and the highest potential for construction mortality. Brown North, Brown South and Green North have an intermediate sized limit of disturbance and intermediate potential for construction mortality. Disturbance to wetlands along the potentially occupied watershed and potential construction mortality has been minimized by spanning the wetlands with bridges and limiting the placement of fill in wetlands along the potentially occupied watershed.

Other measures to ensure minimal mortality during construction include installing silt fencing around the construction area within the potentially occupied watershed's wetlands and having a qualified bog turtle surveyor present to conduct a pre-construction survey of the construction area for turtles. This exclusionary fence and the construction area could also be monitored by a qualified bog turtle surveyor for the duration of the construction.

Hydrologic Changes

The Yellow, Purple, Brown, and Green Alternatives have the potential for causing hydrologic changes because they cross the potentially occupied watershed and introduce impervious surface within the potentially occupied watershed. The Yellow and Purple alternatives have the smallest additional impervious area and the lowest potential for hydrologic changes. Green South has the largest additional impervious area and the highest potential for hydrologic changes. Brown North, Brown South and Green North have an intermediate amount of additional impervious area and intermediate potential for hydrologic changes. It is important to note that beavers are very active within the potentially occupied watershed (and all project area watersheds) and are continually altering hydrology within the wetlands by alternatively flooding and drying up wetlands as dams are created and breached.

Stormwater management is a key component of this project and would be included in all build alternatives. Stormwater management facilities would be designed to manage both water quantity and quality. Stormwater runoff would be directed to these facilities prior to entering the wetlands along the potentially occupied watershed and the facilities would be designed to maintain the existing water regime with the incorporation of infiltration and discharge facilities. Maintenance of the existing water regime would help to maintain the groundwater levels and recharge necessary to continue to supply these groundwater-fed seeps within the wetlands along the potentially occupied watershed. All road-related runoff would be directed into stormwater management facilities.

Any hazardous materials in the stormwater runoff would also be captured in the stormwater management facilities and allowed to settle out prior to the water reentering the nearby wetland systems. In case of an accidental hazardous materials spill from trucks, spills could be contained with the stormwater management facilities until emergency response cleanup is completed.

Introduction of Invasive Plant Species

The Yellow, Purple, Brown and Green Alternatives have the potential to introduce invasive plant species into the potentially occupied watershed. Invasive plants can be introduced by seeds in foreign soils used as fill material, through seed transport along road corridors, and through soil disturbance permitting invasive species to establish before native species. Invasive species encroachment on bog turtle habitat can negatively change the plant composition to make the habitat undesirable or unusable to bog turtles. It is important to note, however, that many of the wetlands along the potentially occupied watershed already have invasive species within the wetland. Invasive plant species introductions would be minimized by limiting disturbance to wetlands along the potentially occupied watershed and limiting the amount of fill placed in wetlands along the potentially occupied watershed.

Bald Eagle and Other Species

The Yellow, Purple, Brown and Green Alternatives would not impact the bald eagle nest site which is known to occur along Scott Run. The nest along Scott Run would be located outside of the area of potential impact for these alternatives, and would be outside of the buffer requirements. USFWS normally recommends that a year-round buffer of 750 feet remain undisturbed around bald eagle nests to avoid direct impacts (a “take”). In addition, a time-of-year restriction on construction activities within a quarter mile of an eagle nest has been established from December 15 through June 15 to avoid disturbance to nesting eagles and ensure successful incubation and rearing of young. Disturbances to the nest and surrounding area will be avoided. No impacts to bald eagle nest sites are anticipated in the vicinity of US 301 near Middletown as no nests are located in this area.

The Yellow, Purple, Brown and Green Alternatives are located within the area identified by DNHP where several rare, threatened, or endangered species have been previously identified. There are no anticipated impacts to the following state listed species: four-toed salamander, great purple hairstreak, Mitchell’s sedge, alewife floater, marsh marigold, hairy woodrush, and abruptly bent backed flatsedge; these species were not incidentally observed within the project area during field investigations. These field investigations were not focused on rare species and were conducted by biologists not specifically trained to identify rare species. All of the retained alternatives have the potential to impact the queen snake; the Brown North Alternative would impact all the wetlands in which the queen snake was identified. The Yellow Alternative would impact the queen snake along Scott Run while the rest of the alternatives would impact the queen snake along Scott Run and Back Creek. The queen snake is a wetland dependant species and avoidance, spanning, and minimization of impacts to wetlands along with compensatory wetland mitigation would limit impacts to the queen snake. The Yellow Alternative would impact cattail sedge, a state rare species identified during field investigations.

10. Wild and Scenic Rivers

a. Existing Conditions

National Wild and Scenic Rivers System information is maintained by the National Parks Service (NPS) and categorized by state. Furthermore, the NPS manages the Nationwide Rivers Inventory (NRI) which lists more than 3,400 free-flowing river segments in the United States.

Wild and Scenic Rivers of the United States, along with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, and cultural values. They are to be preserved in a free-flowing state, and they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.

The Nationwide Rivers Inventory (NRI) lists river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. Under a 1979 Presidential directive, and related

Council on Environmental Quality guidance, all federal agencies must seek to avoid or mitigate actions that would adversely affect one or more NRI segments.

White Clay Creek has received the Federal Wild and Scenic River designation. The White Clay Creek Wild and Scenic Rivers System Act designated approximately 190 miles of segments and tributaries of the White Clay Creek as components of the national system. This includes virtually the entire watershed, a first time occurrence in the national system. The White Clay Creek watershed comprises approximately 70,000 acres or 100 square miles in Pennsylvania and Delaware. White Clay Creek joins the Christina River near Newport, Delaware, which in turn flows into the Delaware River near Wilmington.

Nineteen miles of the Sassafras River, from its headwaters in Kent and Cecil Counties, Maryland and New Castle County, Delaware, to its confluence with the Chesapeake Bay, were listed in 1982 on the NRI and considered to have outstandingly remarkable recreational, fish, wildlife, and other values. The watershed drains approximately 48,326 acres within a portion of western New Castle County. The watershed's eastern boundary roughly parallels SR 15 and extends westward out of the project area into the State of Maryland.

b. Environmental Consequences

White Clay Creek and its entire watershed is located north and east of the project area and will not be impacted by the US 301 project. The watershed for the Sassafras River, listed on the NRI, lies within the project area boundaries. Headwaters would be impacted by the southern portion of all build alternatives.

There would be no direct impacts to the Sassafras River or its tributaries resulting from any of the build alternatives. Impacts to the Sassafras River watershed could result from roadway runoff, sedimentation, and alterations to hydrology. These impacts could potentially lead to a decrease in scenic value, recreational use, and plant and animal species that inhabit these areas.

11. Coastal Zone Management Area

a. Existing Conditions

As mandated by Section 307 of the Federal Coastal Zone Management Act (CZMA) of 1972, each coastal state must develop a federally approved Coastal Zone Management Program (CZMP). Any federal action which is reasonably likely to affect any land or water use, or natural resource of a state's coastal zone, must be conducted in a manner that is consistent with the state's federally approved CZMP. Activities are reviewed by the appropriate agency to ensure consistency with the state's CZMP as part of the Federal Consistency process. In Delaware, the consistency review is initiated through submittal of a separate application to the *Delaware Coastal Management Plan* (DCMP). A representative of the Delaware CZMP has participated in the US 301 Project Development effort and has been involved in the development and review of this DEIS. In Maryland, the consistency process is initiated through application for a federal permit.

The limits of the Coastal Zone in Delaware are defined as the entire state for the purposes of the federally approved coastal management program (DCMP, 2004). In Maryland, the Coastal Zone includes Cecil County, and therefore the area where existing US 301 is located (MDE, 2004). Because the entire project area lies within the Coastal Zones of Maryland and Delaware, all activities will be subject to the Federal Consistency Process. The review process will analyze the proposed activity for consistency with existing land uses and impacts to coastal resources.

b. Environmental Consequences

No impacts to the Coastal Zone are anticipated as a result of the No-Build Alternative. A small portion of the Yellow, Purple, Brown, and Green Alternatives is located within the Coastal Zone of Maryland. The remainder of these alternatives is located entirely within the Coastal Zone of Delaware.

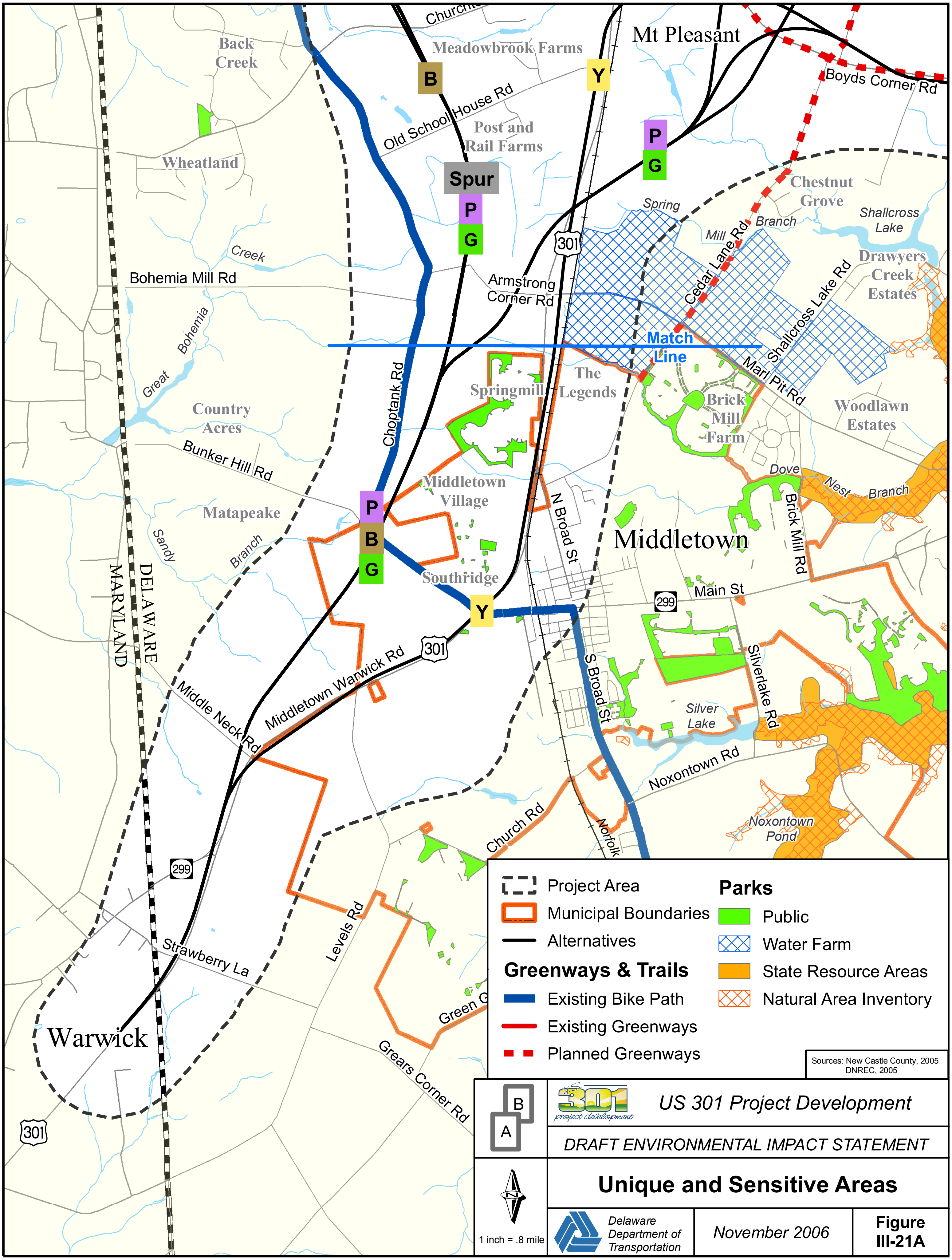
Because impacts to federally regulated wetlands are anticipated as part of this project, a Coastal Zone Consistency Statement will need to be obtained before any federal permit activities could occur as part of any alternative. In Delaware, a Consistency Statement will need to be applied for separately from any application for a permit for wetland impacts. The Consistency Statement application will be submitted in Delaware when the final ACOE permit is submitted. In Maryland, this process will occur as part of the application for a federal permit. The Selected Alternative will be designed and constructed in a manner that remains consistent with the policies of both Delaware's and Maryland's Coastal Zone Management Programs.

12. Unique, Sensitive and other Natural Areas

a. Existing Conditions

Unique and Sensitive Areas include areas with special environmental qualities or historical uniqueness and sensitivities. Some of these areas may be represented in other sections of the DEIS. Unique and Sensitive Areas need special attention during the planning, design and management phases of the project to avoid or minimize impacts wherever possible in order to maintain their remarkable character. A variety of areas are included in this section including state resource areas, state wildlife area lands, greenways and trails, sensitive wildlife habitat, and designated natural areas. ***Figure III-21*** shows the unique and sensitive areas in or adjacent to the project area.

Delaware's *State Strategies for Policies and Spending* (1999, updated 2004), also known as *Livable Delaware*, directs the focus of state development and land use programs to those areas most suitable. "Green Infrastructure", defined in Executive Order #61, defines those areas that focus on croplands, forestlands and natural resources and recreation lands by mapping, and uses that mapping to develop goals and strategies for preservation of natural resource areas, recreational lands and working lands.



US 301 Project Development

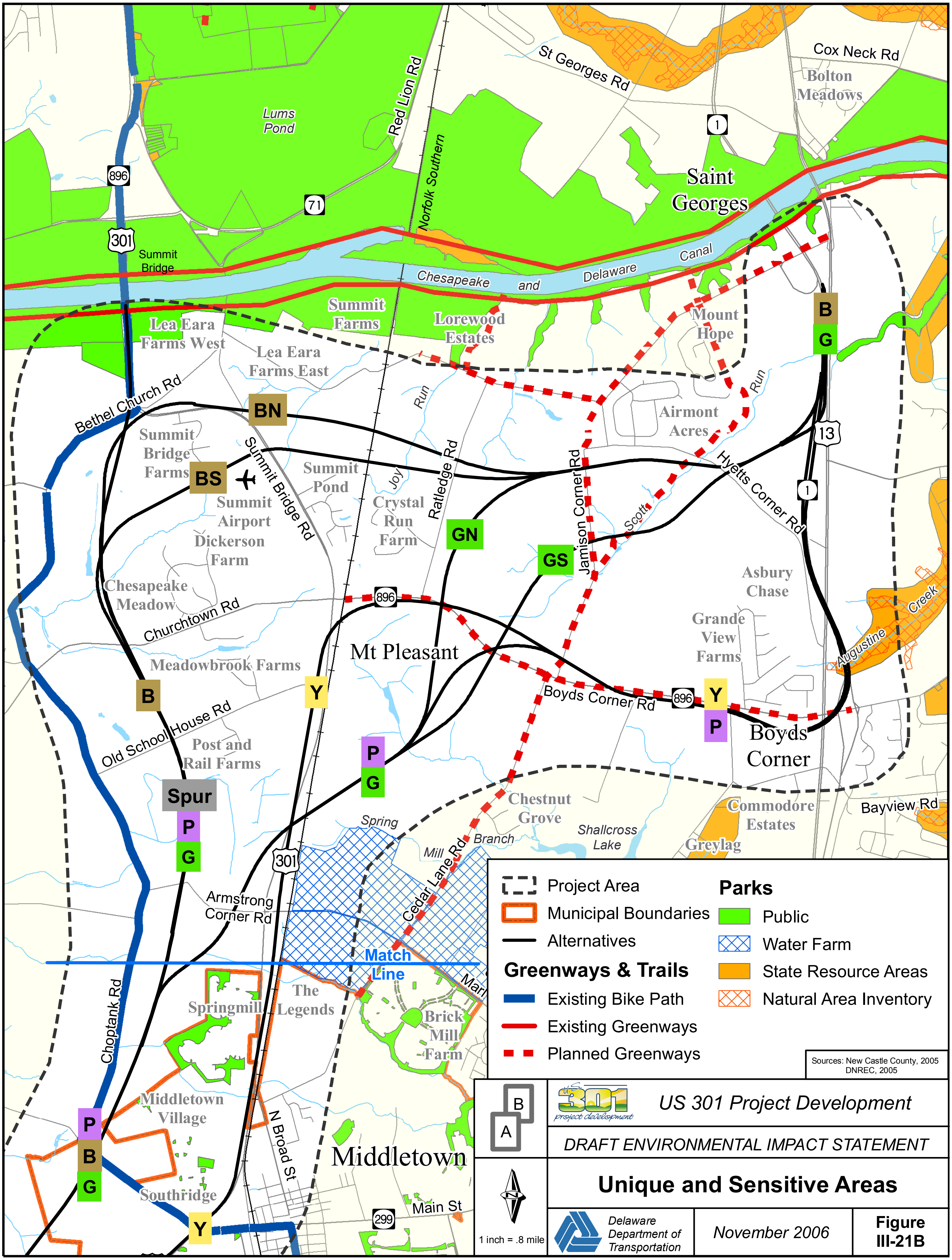
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Unique and Sensitive Areas

Delaware Department of Transportation

November 2006

Figure III-21A



US 301 project development

US 301 Project Development

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Unique and Sensitive Areas

Delaware Department of Transportation

November 2006

Figure III-21B

A variety of resources were used to develop the Unique, Sensitive and Other Natural Areas section. The GIS database for New Castle County and Delaware provided designated environmental features and boundaries within the project area. DNREC and Maryland DNR websites provided details on the unique and sensitive areas. Unique and Sensitive Areas are described below by category.

State Resource Areas

The development of State Resource Area (SRA) maps was authorized in 1990 by the Delaware Land Protection Act (7 Del Code, Chapter 75). The maps are used to guide local land use planning in the protection of unique ecological functions and for guiding acquisition of property or rights in real property through the Open Space Program. SRAs include existing protected state, federal, local and private conservation organization lands. SRA maps were updated in 2006, and include some of the finest examples of Delaware's diverse natural and cultural heritage, unspoiled wetlands, mature forests, rare plant and animal habitats, geological and archaeological sites, open space for recreation and greenway connectors.

Noxontown Pond is a 493-acre designated State Resource Area located south of the project area.

The *C&D Canal State Resource Area* includes 1,760 acres of freshwater marshes (Dragon Run and Thousand Acre Marsh), 20.3 miles of shoreline, significant geological features, three state Natural Areas, and approximately 1,500 acres of forestland. The alternatives cross the C&D Canal SRA at the base of Summit Bridge, and the Green and Brown Alternatives cross Scott Run within the C&D Canal SRA.

Lums Pond State Park is a 1,790 acre state park located north of the C&D Canal, outside of the project area. This park encompasses the largest freshwater pond in Delaware and features a variety of recreational sports facilities and hiking trails. Lums Pond is a management unit within the C&D Canal SRA.

Natural Areas

In 1978, the State of Delaware enacted the Natural Areas Preservation System (7 Del. Code, Chapter 73) to establish an inventory of natural areas statewide and a system of nature preserves. A natural area is defined as an "area of land or water, or of both land and water, whether in public or private ownership, which either retains or has reestablished its natural character, or has unusual flora or fauna, or has biotic, geological, scenic or archaeological features of scientific or educational value." Nature preserves are those natural areas that have been formally dedicated or transferred to DNREC for and on behalf of the State.

Augustine Creek is a Natural Area. The Yellow and Purple Alternatives cross Augustine Creek at their tie-in with SR 1.

Noxontown Pond is a Natural Area and is described above under State Resource Areas.

State Wildlife Area Lands

State Wildlife Area Lands were designated for a number of reasons to serve the public and manage wildlife. These lands provide management and refuge areas for upland animals, provide biological diversity through the maintenance of varied ecosystem habitats, and provide hunting grounds. The project area contains State Wildlife Area Lands, managed by the DNREC Division of Fish and Wildlife (Natural Heritage and Endangered Species (DNREC), personal communication, July 25, 2005).

The C&D Canal is a designated State Wildlife Area. The canal connects the Delaware River, south of Delaware City, to the Chesapeake Bay. The north and south banks of the canal include more than 5,100 acres of protected lands, managed by both the Divisions of Fish and Wildlife and Parks and Recreation. The C&D Canal Wildlife Area has been divided into specified areas used for wildlife refuge, waterfowl hunting, deer hunting, and dog training.

Greenways and Trails

Delaware Greenways identifies publicly-owned corridors for the protection of open space. These areas often contain water features, are managed for conservation and recreation, and often link parks, cultural or historic sites with populated areas. Greenways usually contain trails for walking and biking.

Twelve miles of greenway trails are located on both the north and south banks of the C&D Canal. These greenways are managed by the Divisions of Fish and Wildlife and Parks and Recreation.

b. Environmental Consequences and Mitigation

Based on information received from DNREC to date, impacts to unique and sensitive areas would occur with all of the build alternatives. The Yellow and Purple Alternatives would impact the Augustine Creek State Natural Area near SR 1. All of the alternatives could impact the C&D Canal SRA near the Summit Bridge. Both the Brown Alternative and the Green Alternative could impact Scott Run within the C&D Canal SRA. Other impacts could include those associated with shade, noise and bridge runoff. There are no impacts to "green infrastructure" areas under any of the retained alternatives.

There are no standard mitigation requirements for State Resource Areas and State Natural Areas (E. Butler (DNREC), personal communication, August 17, 2006). Mitigation for impacts to State Resource Areas, Natural Areas, State Wildlife Area Lands, and Greenways and Trails have been addressed under other resources including community facilities, waters of the US, forested lands, surface waters and habitat resources. Coordination with DNREC to further avoid, minimize or mitigate impacts will continue during the project development process.